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A TOTAL OF NINETEEN MILLIONS.

It is now more than probable that the output of iron ore from Lake Superior mines, both lake and rail, in 1900, will be a little in excess of 19,000,000 gross tons, as against 18,251,804 gross tons in 1899. The total by lake to Nov. 1 is 17,287,952 tons, as against 15,594,298 tons on the same date in 1899. October shipments this year aggregated 2,402,887 tons; in 1899, 2,549,424. The shipments from the first of November to the close of navigation last year footed up 2,301,424 tons, but probably not much more than half this amount will be shipped during the balance of the present season. Shipments by months in 1899 and 1900 were as follows:

IRON ORE OUTPUT LAKE SUPERIOR REGION.

Months.	Gross tons, 1900.	Gross tons, 1899.
April and May	3,265,888	2,125,061
June	3,149,952	2,628,895
July	3,038,560	2,902,867
August	2,911,622	3,013,645
September	2,519,043	2,374,406
October	2,402,887	2,549,424
Total to Nov. 1	17,287,952	15,594,298

Shipments of hard coal from Buffalo by lake to Nov. 1 were 652,601 tons short of last year to the same date. Doubtless the shortage of rail shipments amounts to fully as much as the shortage of lake shipments. Shipments by both lake and rail have been very light this month to date and will continue to be light until about the 15th inst. when it is expected the shipments will be at least normal, both by lake and rail.

CARGO RECORDS OF LAKE FREIGHTERS.

Some very large cargoes have been carried recently by lake steamers. Mr. H. A. Foss, board of trade weighmaster at Chicago, gives the following items making up a grain cargo loaded by the Rockefeller steamer Gen. O. M. Poe at South Chicago, a few days ago: Wheat, 79,000 bushels; C. W. oats, 119,200 bushels; oats, 162,000 bushels. This is equivalent to 429,325 bushels of oats. In weight this cargo is not quite equal to one of 269,000 bushels of corn (7,532 net tons), taken out of South Chicago several weeks ago by the steamer Simon J. Murphy. The steamer Isaac L. Elwood, A. B. Wolvin of Duluth, manager, loaded at Buffalo, Wednesday, 7,688 net tons of anthracite coal for Duluth. This is the largest cargo of coal ever put into a lake vessel, although iron ore cargoes have aggregated as much as 8,339 net tons. A very valuable cargo was that taken aboard the steamer Howard L. Shaw last week at Duluth. The Shaw loaded about 260,000 bushels of flaxseed, the value of which was about $468,000. Cargo and vessel were together worth three-quarters of a million. Cargo records to date are as follows:

Iron Ore—Steamer William Edenborn, A. B. Wolvin of Duluth, managing owner, 7,446 gross or 8,339 net tons, Two Harbors to Conneaut; tow barge John Smeaton, owned by Bessemer Steamship Co. of Cleveland, 7,446 gross or 8,339 net tons, Duluth to Cleveland, draught 18 ft. 1 in.; tow barge Manila, Minnesota Steamship Co. of Cleveland, 7,300 gross or 8,237 net tons, Two Harbors to South Chicago, draught of 18 ft.

Grain—Steamer Simon J. Murphy, owned by Eddy Bros. of Bay City, 269,000 bushels of corn, equal to 7,532 net tons, South Chicago to Buffalo; steamer Superior City, A. B. Wolvin of Duluth, manager, 266,550 bushels of corn, equal to 7,463 net tons, South Chicago to Owen Sound, draught of 18 ft. 2 in.; steamer Douglas Houghton, Bessemer Steamship Co., 308,300 bushels of clipped oats and 60,000 bushels of corn, equal to 7,520 net tons, Manitowoc to Buffalo.

Coal—Steamer I. L. Elwood, owned by American Steamship Co., 7,688 net tons anthracite, Buffalo to Duluth; steamer O. M. Poe, owned by Bessemer Steamship Co. of Cleveland, 6,585 net tons of bituminous, Erie to Duluth.

LAKE SHIPS FOR ATLANTIC COAST TRADE.

Profitable freights are offered just now in the coal trade on the Atlantic seaboard, and it will be interesting, therefore, to watch the operation of four steel vessels built on the great lakes for Atlantic coast trade and which are now about to pass down the St. Lawrence. The vessels are the steamers Paraguay and Asuncion and the tow barges Loyalty and Liberty. The Paraguay has started for New York and she will be followed, probably in a week or ten days, by the Asuncion, towing the two steel barges. These vessels are owned by the International Transportation Co., of which A. B. Wolvin of Duluth, Minn., is managing owner, and are of about 3,000 tons capacity each. They represent the best practice in lake ship building, and it will be surprising if their complete equipment does not give them considerable advantage over vessels operated by most of the towing companies on the coast. The lake practice of having the towing steamer carry a load almost equal to the barge that is being towed will be new to the seaboard. But there is no fear on this score of the success of these vessels. They go to salt water with everything in the way of outfit that has been developed in rapid and enconomical handling of freight on the lakes. Probably the most important device in this line is the towing machine of American Ship Windlass manufacture, which has not been very extensively used on the coast, but which is found on every modern towing vessel on the lakes. It would not be surprising to learn a little later on that the successful operation of these vessels, due to their thorough equipment, especially in the method of towing, will result in a general change in coast practice. The lake vessel managers as a rule are probably quicker to appreciate an improvement than the people engaged in coast towing give them credit for.

NEARLY TWENTY-SIX MILLION TONS.

FREIGHT MOVEMENT TO AND FROM LAKE SUPERIOR WILL EXCEED THE TWENTY-FIVE-MILLION-MARK OF LAST YEAR, NOTWITHSTANDING THE DULL CLOSING OF NAVIGATION.

A short crop in the northwest was the cause of a large falling off in the movement of grain from Lake Superior this season as compared with 1899, but it is still more than probable that the canal records at Sault Ste. Marie will show with the close of the season a total of nearly 26,000,000 net tons of freight moved, or about 1,000,000 tons more than in any other year. The loss is made up by increased shipments of iron ore and soft coal. On Nov. 1 the freight movement aggregated 23,090,766 tons. In wheat there was a decrease in round numbers of 9,500,000 bushels, and in grain other than wheat 13,000,000 bushels. But the ore shipments are of course nearly 2,000,000 net tons in excess of what they were at this time a year ago, and there is a gain of 942,278 tons in the amount of soft coal moved through the canals. The comparisons in full are as follows:

MOVEMENT OF PRINCIPAL ITEMS OF FREIGHT TO AND FROM LAKE SUPERIOR.

ITEMS.	To Nov. 1, 1900.	To Nov. 1, 1899.	To Nov. 1, 1898.
Coal, anthracite, net tons	435,422	691,977	438,083
Coal, bituminous, net tons	3,575,333	2,633,055	2,850,376
Iron ore, net tons	15,255,038	13,307,099	10,834,454
Wheat, bushels	33,340,493	42,988,890	36,505,272
Flour, barrels	5,481,001	5,815,459	6,113,966

REPORT OF FREIGHT AND PASSENGER TRAFFIC TO AND FROM LAKE SUPERIOR, FROM OPENING OF NAVIGATION TO NOVEMBER 1 OF EACH YEAR FOR THREE YEARS PAST.

EAST BOUND.

ITEMS.	Designation.	To Nov. 1, 1900.	To Nov. 1, 1899.	To Nov. 1, 1898.
Copper	Net tons	110,423	99,503	105,180
Grain, other than wheat	Bushels	11,349,003	24,198,127	21,227,335
Building stone	Net tons	36,657	30,342	4,670
Flour	Barrels	5,475,414	5,813,534	6,113,039
Iron ore	Net tons	15,255,038	13,307,099	10,834,454
Iron, pig	Net tons	17,206	20,676	32,267
Lumber	M. ft. b. m.	765,906	910,508	799,491
Silver ore	Net tons	110	.....	.....
Wheat	Bushels	33,340,493	42,988,890	36,505,272
Unclassified freight	Net tons	62,213	109,092	198,600
Passengers	Number	27,515	22,615	19,616

WEST BOUND.

Coal, anthracite	Net tons	435,422	691,977	438,034
Coal, bituminous	Net tons	3,575,333	2,633,055	2,850,376
Flour	Barrels	5,587	1,925	927
Grain	Bushels	92,784	41,500	26,105
Manufactured iron	Net tons	103,109	153,088	189,219
Salt	Barrels	277,338	281,164	229,681
Unclassified freight	Net tons	367,943	375,491	337,575
Passengers	Number	28,174	24,547	22,840

SUMMARY OF TOTAL FREIGHT MOVEMENT IN TONS.

	To Nov. 1, 1900.	To Nov. 1, 1899.	To Nov. 1, 1898.
West bound freight of all kinds, net tons	4,533,787	3,887,124	3,848,122
East bound freight of all kinds, net tons	18,556,979	17,557,630	14,660,926
	23,090,766	21,444,754	18,509,048

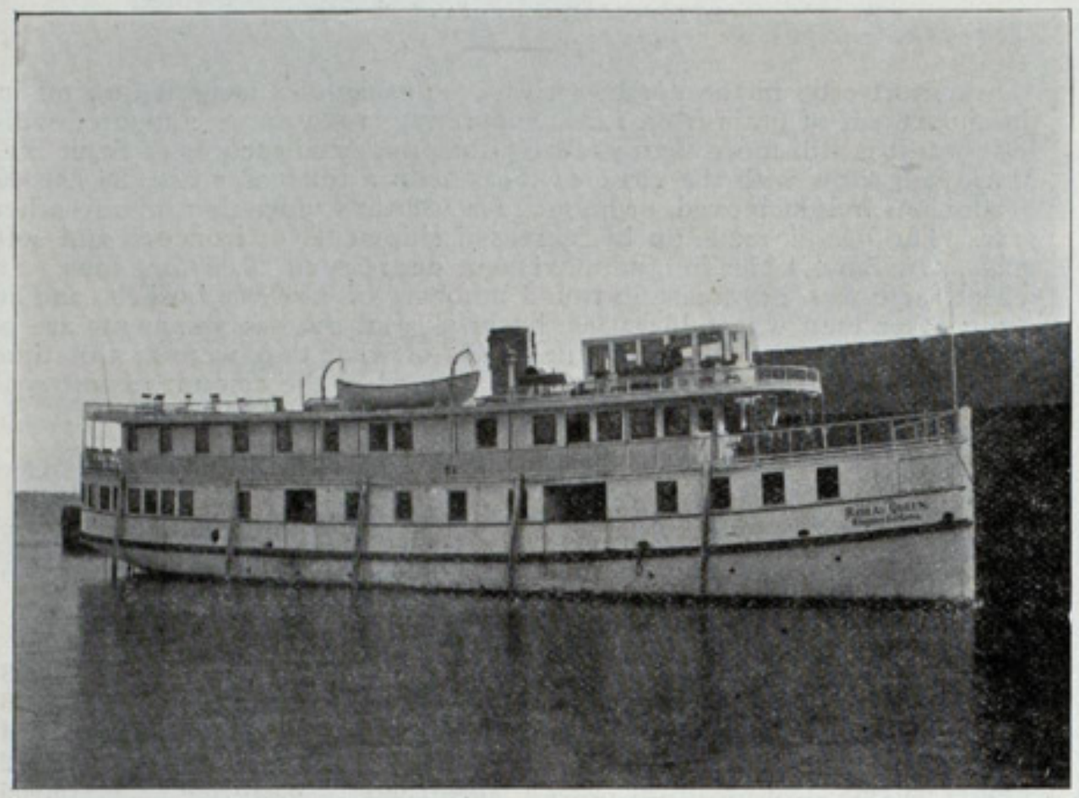
	Vessel passages.	Registered tons.
To Nov. 1, 1900	16,435	20,279,938
To Nov. 1, 1899	17,488	18,852,309
To Nov. 1, 1898	15,775	16,426,472

The rebuilt cruiser Atlanta will shortly leave for South America to join the South Atlantic squadron under Rear Admiral Schley. The Atlanta, which was built in 1885, has been in dry dock at the Brooklyn navy yard for the past three years and has been given a higher freeboard, been redecked, made fireproof and has had her engines changed from the compound to the triple expansion type, increasing them to 4,000 H.P. Her armament now consists of two 8-in. guns and eight 6-in. guns with a secondary battery of rapid fire guns.

A TRIM PASSENGER BOAT.

RIDEAU QUEEN, BUILT AT KINGSTON, ONT., FOR RIDEAU LAKES NAVIGATION CO. —VERY HANDSOMELY FURNISHED.

A small passenger vessel, but a very trim one and in every way up to date, is the steamer Rideau Queen, owned by the Rideau Lakes Navigation Co., Ltd., of Kingston, Ont. The Rideau Queen, alike to other vessels of the fleet to which she belongs, was designed and built by Mr. M. R. Davis of Kingston, who is to build another similar vessel during the coming winter for the same company. The route followed by these vessels between Kingston and Ottawa, Ont., a distance of 126½



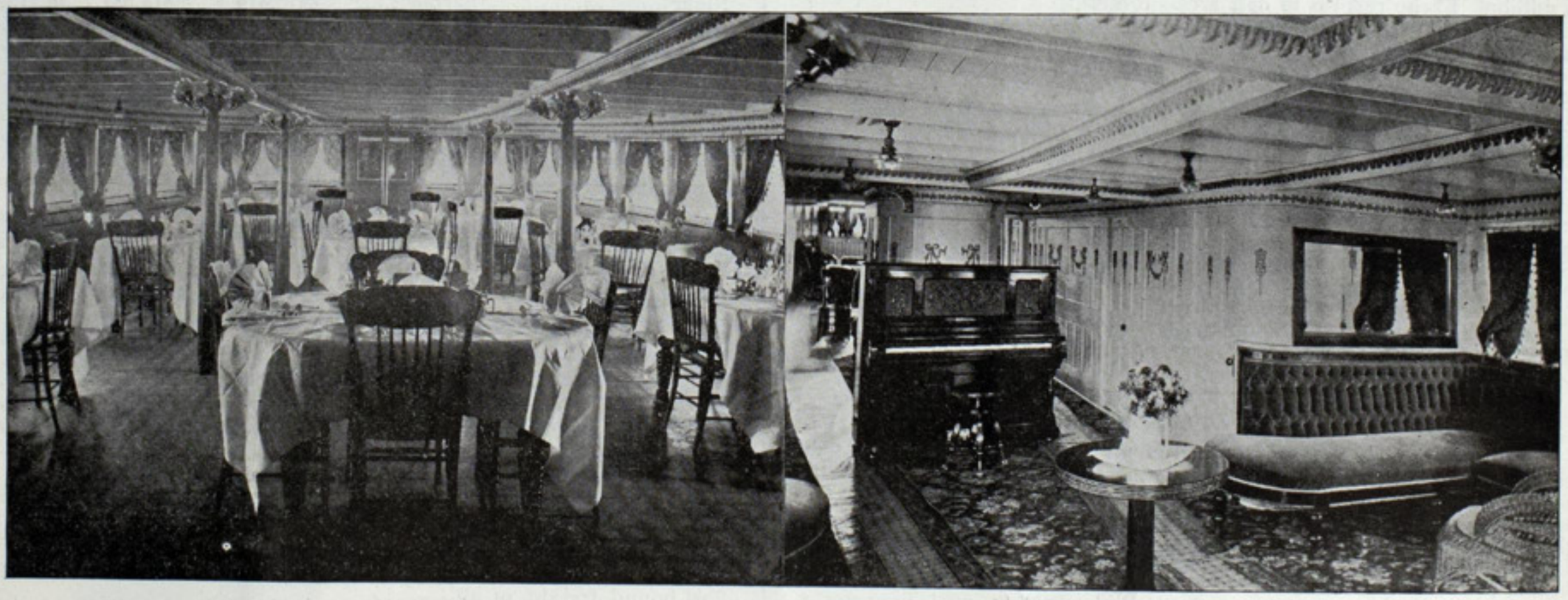
PASSENGER STEAMER RIDEAU QUEEN OF KINGSTON, ONT.

miles, is what is known as the Rideau canal. But it is not an ordinary canal. It is a waterway between the two cities mentioned, made by connecting a large number of beautiful lakes. The actual canal is comparatively short, while the lakes afford delightful sails and scenery. The canal was constructed by the British government as a military work, at a cost of $5,000,000, as far back as 1830. If, in the time of war, the navigation of the St. Lawrence was interrupted, this canal, in conjunction with the Ottawa river, would furnish direct communication between Montreal and the great lakes.

Dimensions of the Rideau Queen are: Length over all, 111½ ft.; length on water line, 102 ft.; beam over all, 28 ft.; draught, aft, 4½ ft.; draught, forward, 3 ft.; displacement, about 200 tons. The hull is built of oak and tamarack (double frame) all screw-bolted throughout, with a double row of arches the full length of the steamer under decks. As the limit of draught in the canals is 5 ft., it was quite a difficult matter to secure in the design all that was required for an up-to-date steamer, but after a season's work the owners are more than satisfied with their vessel.

Engines are triple expansion with cylinders of 8½, 12¾ and 27 in. diameter and a common stroke of 14 in. The high and intermediate cylinders have piston valves, with flat slide valve for the low pressure. Steam at 200 lbs. pressure is supplied by a water tube boiler of 8 ft. width, 9 ft. height and 9 ft. length, containing 1,500 sq. ft. of heating surface. With the engines turning 125 revolutions per minute the speed of the vessel is full 12 miles an hour.

In the arrangement of cabins, state rooms and general accommodations for passengers this vessel is as complete as the largest of the passenger steamers on the great lakes. On the main deck aft is the dining room where seventy-two people may be comfortably seated. This room is 41 ft. long, extends the full width of the vessel and is unusually well lighted. It is finished in oak and nicely decorated with plenty of hooks, racks and other conveniences. A ladies' cabin, 80 ft. long, is one of the features of the vessel as regards finish and furnishings. This cabin is finished in white with green and gold trimmings, this style prevailing quite generally in the cabins. A ladies' toilet, finished in red oak and highly polished, contains every convenience that might be desired, and forward of it is a bath room, similarly finished, and having hot and cold water connections with the best of plumbing throughout. Some seventeen or eighteen state rooms, all elegantly finished, have running water as well as a cold air pipe for a supply of fresh air, furnished by a fan from the lower part of the vessel. The fan is operated by an independent motor. The vessel is very well lighted by electricity. There are 240 lights of 10 to 16 candle power, with a few of 32 candle power. All are arranged in groups, which are controlled by twenty-four switches in the engine room under the eye of the engineer, who has full control of the lights. The vessel is also supplied with a full set of oil lamps for use in emergency. It will probably be noted that the vessel's smoke stack is very low. This is necessary on account of the large number of bridges on the Rideau route. On other vessels of the line an arrangement for lowering stacks is in use, but it is troublesome and expensive, and hence the lower stack in this steamer. Concerns taking part in the construction of this vessel are: Davis Dry Dock Co., Kingston, engines and boilers; Snow Pump Works, Buffalo, all pumps and condenser; Buffalo Forge Co., Buffalo, ventilating fan for air system; Racine Hardware Mnfg. Co., Racine, Wis., electric light engine; Waddell Mnfg. Co., Grand Rapids, Mich., all sawed mouldings; Geo. Mertz Sons, Port Chester, all embossed mouldings.



VIEW OF LADIES' CABIN AND DINING ROOM, PASSENGER STEAMER RIDEAU QUEEN.

LONG VOYAGE WITH LIQUID FUEL.

The steamship Cowrie of the Shell Transport & Trading Co., managed by Sir Marcus Samuel & Co., which recently discharged a cargo of oil in the Thames, steamed all the way from Koetei, in Borneo, to London—9,250 miles—using nothing but liquid fuel; and the boilers for supplying the steam for the pumps which discharged the cargo are fired by the same material. The oil is not burned by a thin layer of incandescent coal, as is the case in some systems, but is pulverized or reduced to spray by means of a steam jet at the furnace door, where it is delivered from furnace tanks above the boilers. The Cowrie was formerly fired with coal, and her conversion to liquid fuel has been attended with advantageous results. Her complement of stokers has been reduced to six, as against sixteen necessary with coal, and her speed has at the same time been slightly improved. Moreover, the change has effected an important saving in bunker space, for her consumption of oil on this voyage was only 22 tons a day, whereas her daily consumption of coal used to be 35 tons, and a ton of oil is calculated to occupy only 34 cu. ft., against 45 ft. required for coal. Oil, too, can be carried in the water-ballast tanks, and can also be taken on board much more quickly than coal—on a recent occasion 300 tons were pumped into a German steamer in one hour.

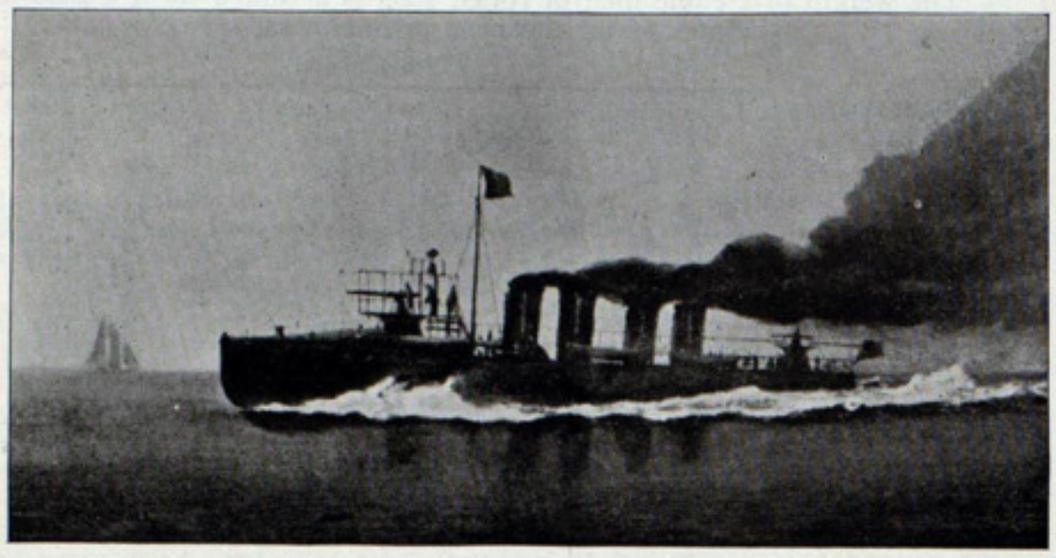
The oil yielded by the Borneo fields forms an excellent fuel when used just as it comes from the ground, and is said to be superseding both the Russian and the American products in the far east, where it is extensively used for fuel in steamers—e. g., the Hamburg-American boats engaged in the eastern trade. To give some idea of its cost, it may be mentioned that, according to the terms of a recent contract, which need not be specified exactly, it is to be delivered at the price of 30 shillings a ton at Singapore and Hongkong, 32 shillings 6 pence ($7.90) at Shanghai, 35 shillings ($8.51) in Japan and Colombo, and 50 shillings ($12.16) at Suez. The Cowrie brought from Borneo over 6,000 tons of solar oil, the greater part of which is destined to be used by the Gas Light & Coke Co. for the production of oil gas for enrichment purposes, and it is an interesting fact that the vessel (or one like her) will be bunkered with the refuse that remains after the oil has been utilized in this manner.—London Times.

Superintendent Kimball of the United States life saving service advertises elsewhere in this issue for proposals for the construction of ten 34-ft. self-righting and self-bailing life boats. Proposals will be opened on the 17th inst.

PROPOSED NAVAL PROGRAM.

Editorial Comment, New York Sun.

The naval board on construction is reported to have prepared a program of ship building to be submitted to the secretary of the navy for his approval. The plan calls for the construction of three battleships, three armored cruisers and twelve gunboats; the exact number of the latter class of vessels, however, has not been fixed. Secretary Long, on the other hand, is understood to desire small gunboats rather than larger and heavier ships, holding that light-draught vessels are more needed in Philippine waters just now than the others. There is likely, therefore, to be some modification in the plan of the board on construction before it is approved by the department. While naval construction must be continued, and while a well-considered program is necessary for the proper development of the navy, it is possible to overcrowd the ship building



Torpedo Boat Destroyer Lawrence, launched on Wednesday at the Fore River Engine Co.'s Works, Weymouth, Mass.

yards; and the board's program appears likely to do this. At present there are some thirteen vessels of large size under construction, as follows: Battleships Illinois, Maine, Missouri and Ohio; cruisers Denver, Des Moines, Chattanooga, Galveston and Tacoma; and the monitors Arkansas, Connecticut, Florida and Wyoming. Besides these, there are seven vessels authorized last year and four vessels authorized this year for which contracts have not been awarded. These eleven vessels are battleships and armored cruisers of 12,000 tons and more. There are also three protected cruisers, for the construction of which contracts have not been made. The armor plate question has again been opened. When bids for armor for vessels under contract were opened in August last, three companies competed, but each of them made such conditions that the bids had to be rejected. None of the companies presented bids under the navy department's second invitation, and though attempts have been made by the department and the companies to reach a working agreement, they have been unsuccessful thus far. If some "reasonable price" is not agreed on, the law requires the secretary of the navy to erect an armor plate factory. With the prospect of armor plate remote and indefinite in the extreme if a government factory has to be erected, it seems as if the program for new armored vessels might be laid aside in favor of plans calling for smaller, unarmored craft, suitable for the shallow rivers of the Philippines as well as of China, and much more speedily obtainable. The large battleships and cruisers proposed by the board, while desirable in many respects, are not wholly necessary just at the present time. Besides, they could hardly be begun for a year or more. Such being the case, the plan which calls for their construction may well be laid aside for the present, until the battleships and armored cruisers now building and authorized have got their armor and can make room for their successors on the stocks. No change of naval policy is to be expected as a result of the election; for four years and a half it is likely that the policy of building up the navy will be continued. A comprehensive ship building program, covering those years, would be desirable and might properly call for vessels of every type needed in the navy.

ARMOR PLATE CONTROVERSY NEARING SETTLEMENT.

An agreement has been reached between the navy department and the Carnegie and Bethlehem steel companies, which, while not perfected, will probably lead to a satisfactory adjustment of the controversy over the price of Krupp armor. This controversy has caused great delay in the construction of battleships and armored cruisers, as under the law no contracts for the construction of these armorclads last authorized may be signed until the armor question has been settled. Whether the Midvale Steel Co. will be a party to any armor contract cannot be ascertained. When the bids for armor were opened the Midvale company was found to be the lowest bidder, but it wanted twenty-six months within which to make the first delivery of material. The navy department rejected all the bids and re-advertised. Just before the date set for the second opening the department cancelled the advertisement and no new bids were submitted. In the conferences that have taken place recently between the naval authorities and representatives of the Carnegie and Bethlehem companies all the points at issue have been discussed, and before Secretary Long left for the west the chances of agreement were considered excellent. It is even asserted that a basis of settlement had been arranged before Mr. Long's departure. The Midvale company did not participate in any of the recent conferences. It filed a protest against the rejection of its several bids, contending that the law required the secretary of the navy to award the contract for furnishing armor to the lowest responsible bidder.

Major T. W. Symons, United States engineer at Buffalo, advertises elsewhere in this issue for proposals for the construction of two beacons, with lanterns and a fog signal house, including foundations and protection work in the main south entrance to the new breakwater at Buffalo. The proposals will be opened Dec. 15.

SHIP BUILDING IN GERMANY.

It is a well-known fact that the German ship building industry has experienced a mighty impetus during the last few years. Small yards have developed into first-class ones; the large places are being improved and extended so as to increase their capabilities; and fresh efforts are constantly being made to start new ship building establishments. Notwithstanding the great progress made, however, the fact remains that the German yards are not yet able to supply the constant demand for new vessels. German ship owners are still compelled to go abroad—to England especially—for a large proportion of the new tonnage they require. In proof of this statement, it will suffice to mention that at present twenty-two ocean steamers are in process of construction in English yards for Hamburg account alone. The German shipping trade is increasing more and more, and the ever-growing cargo and passenger traffic is making heavier demands upon the resources of the ship yards than can well be satisfied. The two great Hamburg and Bremen companies (Hamburg-American line and North German Lloyd) are constantly putting the German yards on their mettle as regards size, build, and speed of new vessels, and these two companies alone could probably keep several ship yards in constant employment. And to cap all this, there are the new demands made, and to be made, upon the ship building firms in connection with the scheme for increasing the navy, and the growing requirements of inland navigation and the coasting trade. In the meantime, the German yards are being put into a condition calculated to enable them to cope, as far as possible, with the new claims made upon them. Leaving out of sight the ship yards in the possession of private individuals or families, of which there are many, four great establishments in Stettin, Kiel, Flensburg and Bremen have increased their capital in the first eight months of the present year by—altogether—nearly 6,000,000 marks. This additional capital has been expended exclusively on extensions of the working capabilities of the yards. It is also a noteworthy fact that in several German seaports earnest endeavors are being made to lay down new ship building establishments. On the Lower Weser, for example, in the neighborhood of Nordenham, an extensive yard is to be located, involving a large outlay of capital. The Grand Duke of Oldenburg is said to be the friend and patron of this project. At Stralsund, too, it is intended to establish a ship building company, with a capital of 4,000,000 marks. Last year there was a serious question of setting up a yard at Apenrade, but this scheme did not mature, although it cannot be said to be entirely abandoned. It is said, also, to be the fixed intention of the Vulcan Ship Building & Engineering Co. of Stettin to plant a branch establishment somewhere on the shores of the North Sea. In direct connection with this forward movement of German industry may be mentioned the projected setting up of the first steel foundry and rolling works on the Baltic coast. These establishments are to be located at Rendsburg and Danzig, and the preliminary works have already commenced. Some of the most important German ship building companies are identified with these undertakings, the idea being that the ship yards shall be supplied from these works with the metal building materials required. Before the lapse of many years, therefore, it is quite possible that Germany will have become independent of foreign aid for the development and recuperation of both her mercantile and military navies.

IMPORTANT OCEAN SURVEYS.

The Fish Commission's steamer Albatross, which returned to San Francisco recently after a fourteen months' cruise in the Pacific, made some important discoveries during the voyage. It was found that all the charts of the South Pacific are very inaccurate, and that most of the islands, except the Fiji and Tahiti, are placed from two to twelve miles away from their actual position. The Albatross also discovered that the temperature of the bottom of the sea at all depths from 500 fathoms to the greatest depth obtainable was the same 35° Fah. Between the surface and 2,500 fathoms down they found edible shrimps varying in size from half an inch to a foot. The Albatross broke the record for deep sea dredging, dragging the bottom at 4,200 fathoms. The greatest depth ever dragged before was 3,000 fathoms by the British ship Challenger in 1876. In the Behring sea the Albatross found at a place where the charts show 2,000 fathoms that the depth was only 200 fathoms. The vessel was gone fourteen months and did an immense amount of work. The results of the surveys will be embodied in the government charts. Commander J. F. Moser commands the Albatross.

NEW WHITE STAR LINER CELTIC.

Some particulars have been secured recently of the steamer which Harland & Wolff, Belfast, Ireland, are building for the White Star line and which is to be of greater size than the Oceanic. She is not intended to be as speedy as the Oceanic. The new vessel, to be known as the Celtic, will be 680 ft. long, 75 ft. beam and 49 ft. in depth. This length is taken over the main deck so that over all this steamer will not be far short of 700 ft. long. Her beam is 7 ft. greater than that of the Oceanic while her gross tonnage will be 3,000 tons more. In fact she will have a greater width than any merchant vessel in the ocean trade. In her internal fittings and arrangements she will practically be an enlarged Cymric, and in addition to excellent and roomy accommodations for passengers will have an enormous cargo capacity. She is intended for the New York service of the White Star line. She will be propelled by twin screws, fitted with bilge keels, and is expected to maintain an average sea speed of 16½ knots with a reserve of power.

Referring in his annual report, issued a few days ago, to the subject of coast defense, Gen. Wilson, chief of army engineers, says that the war with Spain had the effect of hastening the work on the coast defenses to such an extent that now, ten years after that long-neglected work was begun in earnest, he is able to report that 50 per cent. of the work is complete. Twenty-five of the principal harbors of the United States now have a sufficient number of heavy guns and mortars in place to offer an effective defense against naval attack. Existing projects contemplate the mounting of a great number of additional guns, and it is pointed out that there is an urgent need for an increase of the artillery arm of the service, now too small to take care of the coast defenses, and for active measures for the defense of our new island possessions, particularly Porto Rico and Hawaii.

MATERIAL FOR SHIPS.

WHAT WOULD BE REQUIRED ACCORDING TO PROPOSED STANDARD SPECIFICATIONS UPON WHICH EXPERTS ARE AT WORK.

The steel experts who are trying to bring about standard specifications for tests of different materials held another meeting in New York recently. They discussed the specifications for steel rails, specifications for structural steel for buildings and specifications for bridges and ships. The proposed specifications relating to steel for bridges and ships as they now stand are as follows:

1. Steel shall be made by the open hearth process.

2. Each of the three classes of structural steel for bridges and ships shall conform to the following limits in chemical composition:

	Steel made by the acid process. Per cent.	Steel made by the basic process. Per cent.
Phosphorus shall not exceed	0.08	0.06
Sulphur shall not exceed	0.06	0.06

3. There shall be three classes of structural steel for bridges and ships, namely: Rivet steel, soft steel and medium steel, which shall conform to the following physical qualities:

	Rivet steel.	Soft steel.	Medium steel.
Tensile strength, pounds per square inch	50,000 to 60,000	52,000 to 62,000	60,000 to 70,000
Yield point, in pounds square inch, shall not be less than	½ ten. strength	½ ten. strength	½ ten. strength
Elongation, in per cent. 8 inches, shall not be less than	26	25	22

5. For material less than 5-16 inch and more than ¾ inch in thickness the following modifications shall be made in the requirements for elongation:

a. For each increase of ⅛ in. in thickness above ¾ in. a deduction of 1 per cent. shall be made from the specified elongation.

b. For each decrease of 1-16 in. in thickness below 5-16 in. a deduction of 2½ per cent. shall be made from the specified elongation.

c. For pins made from any of the three classes of steel the required elongation shall be 5 per cent. less than that specified in paragraph No. 4, as determined on a test specimen, the center of which shall be 1 inch from the surface.

6. Eye bars shall be of medium steel. Full sized tests shall show 12½ per cent. elongation in 15 ft. of the body of the eye bar, and the tensile strength shall not be less than 55,000 lbs. per sq. in. Eye bars shall be required to break in the body, but should an eye bar break in the head and show 12½ per cent. elongation in 15 ft. and the tensile strength specified, it shall not be cause for rejection, provided that not more than one-third of the total number of eye bars tested break in the head.

7. The three classes of structural steel for bridges and ships shall conform to the following bending tests; and for this purpose the test specimen shall be 1½ in. wide, if possible, and for all material ¾ in. or less in thickness the test specimen shall be of the same thickness as that of the finished material from which it is cut, but for material more than ¾ in. thick the bending test specimen may be ½ in. thick.

Rivet rounds shall be tested of full size as rolled.

d. Rivet steel shall bend cold 180 degrees flat on itself without fracture on the outside of the bent portion.

e. Soft steel shall bend cold 180 degrees flat on itself without fracture on the outside of the bent portion.

f. Medium steel shall bend cold 180 degrees around a diameter equal to the thickness of the specimen tested without fracture on the outside of the bent portion.

TEST PIECES AND METHODS OF TESTING.

8. The standard test specimen of 8 in. gauged length shall be used to determine the physical properties specified in paragraphs Nos. 4 and 5. The standard shape of the test specimen for sheared plates shall be as shown by the sketch accompanying the specification.

For other material the test specimen may be the same as for sheared plates, or it may be planed or turned parallel throughout its entire length, and in all cases where possible two opposite sides of the test specimens shall be the rolled surfaces. Rivet rounds and small rolled bars shall be tested of full size as rolled.

9. One tensile test specimen shall be taken from the finished material of each melt, but in case this develops flaws, or breaks outside of the middle third of its gauged length, it may be discarded and another test specimen submitted therefor.

10. One test specimen for bending shall be taken from the finished material of each melt as it comes from the rolls, and for material ¾ in. and less in thickness this specimen shall have the natural rolled surface on two opposite sides. The bending test specimen shall be 1½ inches wide, if possible, and for material more than ¾ in. thick the bending test specimen may be ½ in. thick.

g. The bending test may be made by pressure or by blows. Sheared edges of bending test specimens may be milled or planed.

11. Material which is to be used without annealing or further treatment shall be tested for tensile strength in the condition in which it comes from the rolls. For material which is to be annealed or otherwise treated before use a full sized section of tensile test specimen length shall be similarly treated before cutting the tensile test specimen therefrom, where it is impracticable to secure test specimens after annealing.

12. For the purpose of this specification, the yield point shall be determined by careful observation of the drop of the beam or halt in the gauge of the testing machine.

13. In order to determine if the material conforms to the chemical limitations prescribed in paragraph No. 2 herein, analysis shall be made of drillings taken from a small test ingot.

VARIATION IN WEIGHT.

14. The variation in cross section or weight of more than 2½ per cent. from that specified will be sufficient cause for rejection, except in the case of sheared plates, which will be covered by the following permissible variations:

h. Plates 12½ lbs. per sq. ft. or heavier, when ordered to weight, shall not average more than 2½ per cent. variation above or 2½ per cent. below the theoretical weight.

i. Plates under 12½ lbs. per sq. ft., when ordered to weight, shall not average a greater variation than the following: Up to 75 in. wide, 2½ per cent. above or 2½ per cent. below the theoretical weight; 75 in. and over, 5 per cent. above or 5 per cent. below the theoretical weight.

j. For all plates ordered to gauge, there will be permitted an average excess of weight over that corresponding to the dimensions on the order equal in amount to that specified in the following table:

TABLE OF ALLOWANCES FOR OVERWEIGHT FOR RECTANGULAR PLATES WHEN ORDERED TO GAUGE.

The weight of 1 cubic inch of rolled steel is assumed to be 0.2833 lb.

Plates ¼ in. and over in thickness.

Thickness of plate.	Width of plate. Up to 75 inches.	75 to 100 inches.	Over 100 inches.
¼ in.	10 Per ct.	14 Per ct.	18 Per ct.
5/16 "	8 "	12 "	16 "
3/8 "	7 "	10 "	13 "
7/16 "	6 "	8 "	10 "
½ "	5 "	7 "	9 "
9/16 "	4½ "	6½ "	8½ "
5/8 "	4 "	6 "	8 "
over 5/8 "	3½ "	5 "	6½ "

Plates under ¼ inch in thickness.

Thickness of plate.	Width of plate. Up to 50 inches.	50 inches and above.
⅛ up to 5/32 inch.	10 per cent.	15 per cent.
5/32 " 3/16 "	8½ "	12½ "
3/16 " ¼ "	7 "	10 "

15. Finished material must be free from injurious seams, flaws or cracks, and have a workmanlike finish.

16. Every finished piece of steel shall be stamped with the melt number, and steel for pins shall have the melt number stamped on the ends. Rivets and lacing steel, and small pieces for pin plates and stiffeners, may be shipped in bundles, securely wired together, with the melt number on a metal tag attached.

17. The inspector representing the purchaser shall have all reasonable facilities afforded to him by the manufacturer to satisfy him that the finished material is furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture prior to shipment.

WORKS OF TOWNSEND & DOWNEY.

The Townsend & Downey Ship Building & Repair Co. of New York, which has works at Shooter's island and offices at 500 Broad street, has lately increased its equipment so as to admit of handling almost any kind of work in the ship building line. On a marine railway of the Crandall kind recently installed at this company's works, the steamship North Sands, 3,526 tons burden, with 550 tons of water and 400 tons of coal in her, was hauled up in twenty-nine minutes from the time she was centered on the keel blocks. There are two speeds at which the machinery can be run, one being twice as fast as the other. The North Sands was hauled up at slow speed, to guarantee absolute safety. The company is now building a twin-screw hydraulic dredging ship for the United States war department for use at Sabine Pass. Delivery of this vessel will be made in the middle of December. There is also under construction a barge for the Tidewater Oil Co. and a contract was secured recently from the government for a composite ship to replace the coast survey vessel Bache.

The ship yard property comprises forty-three acres of land. The wharfage basin is 1,100 by 550 ft. The draught of water is 20 to 25 ft. at low water. The machine shop is 200 by 90 ft., and is a new steel building, equipped with all modern appliances, including a 30-ton electric crane. The blacksmith shop, 120 by 60 ft., is equipped with seventeen forges, steam hammer, etc. The sawing and planing mill is 225 by 60 ft., and is furnished with all modern mills and tools, together with wood-working machinery, capable of doing any work, from the heaviest to fine cabinet work. The plate and angle shop is 200 by 80 ft., and is equipped with complete angle furnaces, bending floors and heavy machinery and tools for iron and steel ship building. All of the machinery is driven by electric power. The mold loft is 245 by 75 ft. The company owns a 930 ft. waterfront and wharf 800 ft. long at Mariners' Harbor, directly opposite the works on the shore of Staten island. The company also owns and operates its own ferry boat between the works and Staten island.

CONTEST FOR THE AMERICA'S CUP.

Sir Thomas Lipton was in Glasgow last week on business connected with his new yacht, the challenger for the America's cup. In an interview he said:

"She is going to be a wonderful boat. There is no question about that. I really believe she will be next year's winner. It is my business to build a boat that will bring back the cup. We have got the best skill and brains obtainable, and nothing will be left undone. Last year's failure has done us good. It taught us things."

It is unofficially stated that Sir Thomas on Saturday last signed contracts with the Hendersons of Glasgow to build the boat, it being stipulated that she shall be handed over to him on March 30. The framework will be laid down this week. Precautions to maintain secrecy have already been taken, and the footpath skirting Henderson's yard has been closed. As Sir Thomas refused to talk in any but a general way about the boat the statements anent the contract, etc., cannot be vouched for.

The forward turret for the 13-in. guns of the battleship Illinois has been placed in position on the vessel at Newport News. All of the main battery of the big fighter and some of the guns of the secondary battery have been assembled at the ship yard, and the Illinois will be ready for her builders' trial trip shortly after Dec. 1.

NOTES FROM SHIP YARDS OF THE GREAT LAKES.

Mr. C. W. Elphicke of Chicago has placed a second order with the American Ship Building Co. for a steel cargo steamer of 6,000 gross tons capacity. This brings the total of new ships to be built by the consolidated yards up to twenty-four. The new vessel is to be a duplicate of the one for which an order was placed several weeks ago—450 ft. over all, 430 ft. keel, 50 ft. beam and 28½ ft. deep. She will have triple expansion engines with cylinders of 23, 38 and 64 in. diameter and 40-in. stroke. Steam will be furnished by three Scotch boilers 13 ft. in diameter and 13 ft. long. The vessel is to be completed in June next.

One of the two 6,000-ton steel steamers, which the American Ship Building Co. is building at Cleveland for Capt. John Mitchell and others, was launched Saturday and named for John J. Albright, capitalist of Buffalo. This vessel is a duplicate of Wm. E. Reis, built at the same yard last year for the same owners. She is 436 ft. over all, 416 ft. keel, 50 ft. beam and 28 ft. deep. She will have triple expansion engines, cylinders 23, 37½ and 63 inches by 42-in. stroke. Steam will be furnished by three Scotch boilers, 12½ by 12 ft.

M. R. Davis of Kingston, Ont., will build during the coming winter for the Rideau Lakes Navigation Co., Ltd., of Kingston, a passenger steamer in nearly all respects similar to the Rideau Queen, built last winter for the same company. The vessel's length over all will be about 110 ft. She will have triple expansion engines and the cabin arrangements will be equal to the finest passenger steamers of the lakes.

Mr. Edward Gaskin of Buffalo says nothing of his plans regarding improvements at the works of the Union Dry Dock Co. (to be Union Steamship Co.) but he is undoubtedly supported by sufficient capital in the purchase of the Buffalo works to undertake their enlargement at once.

John Ingles & Son of Toronto, who are to provide engines for the steel passenger steamer to be built during the winter by the Collingwood Ship Building Co. of Collingwood, Ont., have secured the services of James Smith, who has been connected with the Superior Ship Building Co.'s works for some time past.

The Calvin Co., wreckers and general forwarders of Kingston, Ont., will build at their Garden Island ship yard during the winter a wrecking tug and also a tow barge for lake service of about 2,000 tons capacity. Both will be wooden vessels.

A large wooden steamer which has been under construction for some time past at the ship yard of James Davidson, West Bay City, Mich., will be launched Saturday. The steamer will not, of course, be ready for service until next spring.

Lewis Nixon of Elizabethport, N. J., builder of the Buffalo fireboat Gratton, has just delivered the vessel at Buffalo. The Gratton is 122 ft. long and 22 ft. beam and has a very powerful equipment of fire pumps.

A steam vessel of 68 ft. length (wood hull), to be used by the United States engineer at Buffalo in the conduct of harbor improvements, was launched by Hingston & Woods of that place, Saturday. The vessel was named Major Symonds.

LARGE TRANSFER OF VESSELS.

Although not officially announced as yet, it is more than probable that the twelve steel steamers of the American Steamship Co.'s fleet have been sold to the American Steel & Wire Co. If the price reported—$5,250,000—is anywhere near correct, John W. Gates and his associates in the steamship company, which was organized independently of the big steel and wire organization have made a round sum of money out of these vessels. There are twelve of them—W. H. Gilbert, Zenith City, Queen City, Crescent City, Empire City, Superior City, John W. Gates, J. J. Hill, Isaac L. Elwood, Wm. Edenborn, Palmer and Wolvin. It is understood that the steamers Paraguay and Asuncion and barges Loyalty and Liberty, vessels built for coast service and which are owned by a company whose stockholders are largely the same as those of the American Steamship Co., are not included in the transaction. The twelve steamers involved in the sale were built at an aggregate cost of about $3,350,000. They have undoubtedly earned about $1,000,000 during the season now closing for Mr. Gates and his associates in the American Steamship Co. Management of the vessels will probably not change.

AROUND THE GREAT LAKES.

Capt. John Leonard, who sailed the steamers Tampa, Lloyd Porter and other lake vessels of late years, died in Cleveland, a few days ago. The remains were taken to Ogdensburg for burial. Capt. Leonard was sixty-eight years of age.

During October the marine postoffice employes at Detroit delivered 32,230 pieces of mail and received 10,583 pieces. They sold seventy-one money orders, the aggregate amount of which was $1,492.68. The passages numbered 2,978. There was only one carrier to St. Clair Flats on duty last month and he delivered 5,529 pieces of mail.

Friends of Mr. H. W. Thorp, general manager of the Goodrich Transportation Co., Chicago, are congratulating him upon the arrival at his home of a fine, healthy boy. Mr. Thorp, although general manager of the well-known Chicago company, which has very large passenger and freight boat interests on Lake Michigan, is quite a young man. Since his appointment in October, 1897, he has shown rare tact and executive ability in the management of the company's affairs.

The dispute over the extra handling charges of the wet ore cargo of the steamer Simon J. Murphy in Cleveland last August has been adjusted by a board of arbitration. The men were represented by M. W. Sullivan of Fairport, first vice-president of the Longshoremen's association, and H. Coulby of Pickands, Mather & Co., looked after the interests of the dock company. Rev. Joseph Smith of Ashtabula was the third person. The arbitrators held only two meetings but they examined a number of witnesses and closed the case sooner than was expected. They found all of the ore in the cargo was wet except that under the two forward hatches. They decided the men should be paid extra wages for handling it, and settled the sum at $1,410.85. The men had demanded something over $1.700. When the dispute first came up the owners of the boat refused to pay the extra wages. They deposited the money with the dock company, however, to be paid in case the matter was decided against them.

FULL 14 FT. NAVIGATION FROM LAKES TO SEABOARD.

Mr. Thomas Monro, engineer in charge of Canadian canal improvements in the St. Lawrence, says very positively in a letter to the Review that there is now full 14 ft. navigation between Lake Ontario and Montreal and that vessels of 255 ft. length, 43½ ft. beam and 14 ft. draught can carry cargoes of 2,000 to 2,200 tons through the canals. Mr. Monro's letters is as follows:

Editor Marine Review:—I have been repeatedly asked of late if there is really a 14-ft. channel between Lake Ontario and Montreal; and what is the capacity of the Canadian canals now that they are completed to a 14-ft. draught? As there can be no better means of reaching the people who are most interested in this subject than through the columns of the Marine Review, I beg to state that there is a good practicable channel for vessels drawing 14 ft. between Kingston and Montreal; but, as you are doubtless well aware, pilots are very shy of taking the responsibility of new river navigation where the draught has been increased from 9 ft. to 14 ft. The conditions are so entirely different that confidence can only be attained by experience, and naturally enough a man in charge of so much floating money is timid and wants double or treble assurance that he has plenty under his keel before venturing into what are to him in a measure unknown waters and swift currents. As to the dimensions and capacity of the canals, vessels of 255 ft. in length, 43½ ft. beam and 14-ft. draught can pass through them with ease, carrying cargoes of from 2,000 to 2,200 tons.

By the way, I see in the November number of the Engineering Magazine, in referring to the contemplated trial of direct shipment of steel from Pittsburg to Liverpool, it is stated that four British steamers which have been trading on the lakes will load for home with 1,000 tons of steel, and the ships, "thus laden to 14 ft.," will proceed via the Welland and St. Lawrence canals to Europe. This gives a distinctly erroneous idea of the tonnage capacity of the Canadian enlarged canals. As to the slowness of the St. Lawrence route, its dangers, fogs, shoals, etc., these will eventually arrange themselves to suit the case, when it is found that the natural way of getting from the great lakes to the sea has been at last opened out to fair dimensions, and that the rivers and canals of Canada, by which a vessel of 2,200 tons can pass directly from Fort William, Chicago or Duluth to Liverpool (some 4,500 miles) without breaking bulk, constitute the finest line of steam navigation on the face of the globe.

THOMAS MONRO.

Coteau Landing, Ont., Nov. 3, 1900.

BUFFALO NAUTICAL SCHOOL.

Considerable interest is manifested in Buffalo in the nautical school which Nautical Expert J. C. P. de Krafft is about to establish there. He has received the indorsement of a number of vessel owners of Buffalo, who will urge their captains, mates and pilots to take advantage of the school. Discussing the purposes of the school, Mr. de Krafft said:

"Navigation is one of the most interesting sciences we have, and it surprises one to find how quickly a knowledge of it may be obtained when it is explained in a simple common-sense way by one who understands the theory of the science as well as its practical application. The class room is furnished with everything required to make the study clear and intelligible and all examples are explained by blackboard illustrations as well as by the use of nautical instruments, and a thorough knowledge of the latter is imparted to the student. The two great perils to navigation on the great lakes are fog and snow. Hence, safe navigation is dependent upon a correct compass, with a knowledge and frequent use, on the part of the master, of the azimuth tables, the precaution to take bearings of prominent points, and from them plotting the position frequently on the chart. Also the familiar use of the chart in laying courses and correcting the same for variation and deviation. Lack of the theoretical knowledge of their profession is a drawback to thoroughly successful work on the part of lake captains. They can sail a course safely and truly when the usual landmarks are discernible, but when these are obscured by fog or storm, the lack of the theoretical principles is readily apparent. Special instruction will be given to candidates possessing the necessary practical experience who desire to take examinations before the United States steamboat inspectors for masters', mates' and pilots' licenses. The course of navigation taught embraces the rudiments of the science and such workings as are given below, the same being necessary for navigating a vessel along the coast or on the great lakes:

"Arithmetic of navigation, the compass and its details, variation and deviation of a compass, different methods of determining same, compass adjustment, the subject of time, declination, etc., charts and chart construction, plotting positions by bearings, weatherology and law of storms. In addition to these branches, certain parts of seamanship are taught, such as the log and lead line, rules of the road and parts of ship."

WILBUR-MARTHA COLLISION.

The recent collision at the lower end of the Grosse point cut, Lake St. Clair, whereby the steel barge Martha was sunk by the steel steamer E. P. Wilbur has resulted in a libel being filed in the United States district court at Detroit on behalf of the Minnesota Steamship Co., owners of the Martha, against the steel package freighters Wilbur, owned by the Erie & Western Transportation Co., and the Troy, owned by the Western Transit Co. The Troy is made party defendant because it is represented that she was racing with the Wilbur. The principle of suction is made prominent in the libel. Upon this the libel says:

"The libellant believes that as Wilbur and Troy passed the Mariposa (the Mariposa was towing the Martha) the stern of the Wilbur was drawn to the stern of the Troy by the suction of the latter and that this started the Wilbur on her steer to port."

Jones & Laughlins, Ltd., Pittsburg, have given a contract to the James Rees & Sons Co. for a steel hull river towboat to cost $50,000. The steamer will be 135 ft. long, 24 ft. wide and 4 ft. 6 in. deep.

ENORMOUS NAVAL EXPENDITURES.

ENGLAND'S £30,000,000 ANNUALLY IS ABOUT EQUAL TO THE COMBINED OUTLAY OF THE FOUR GREAT CONTINENTAL POWERS—A COMPARISON IN DEFENSE OF THE BRITISH EXPENDITURES.

From Engineering, London.

In the course of a debate which recently took place in the French chamber, it was stated that Great Britain spends as much on the royal navy as do all the continental powers combined upon their fleets. The statement was made for political purposes, and no doubt served its end of extracting a little extra cash from the pockets of the French taxpayer. Exactly how far it is beyond the truth probably no one knows, for the incompleteness of published figures make a just comparison very difficult; but the statement, startling as it is, cannot be so very far from the mark as might at first sight be supposed. It is hardly necessary, once again in these columns, to insist at any great length on the fact that this empire, with its overwhelming responsibilities, should proportion the size and strength of the navy on the extent of commerce to be protected. We have a lucrative trade and costly goods which form a tempting bait to certain acquisitive persons, and if we wish to retain these possessions, we must not be content with any half-measures, but must adopt such effective means of protection as will prevent any attack from being lightly undertaken. Of late years we have had several bad alarms, and have been frightened into adopting a more prudent course than formerly; but if we are now spending more money on our fleet than ever before, other countries are doing the same. In the following statistics we deal chiefly with the four principal naval powers of Europe, simply because they afford a basis of comparison. We do not impute covetous motives to our neighbors. Still, war is a possibility, as the existence of navies and armies proves; and even if the sentiments of all other nations were friendly at present, we know by experience that a very few weeks, or even a few hours, may serve to quite change the current of opinion.

Our gross total naval estimates for the current year are, roughly, £28,500,000, this sum including over £1,000,000 on account of "appropriations in aid," or money contributed from other sources. The French navy estimates for the present year are about £12,500,000, as voted by the chamber of deputies in March last; those of Russia over £9,000,000; of Germany, not far from £7,500,000 on the original estimates; and of Italy, over £4,500,000. That gives an approximate total of £33,500,000 for the four chief naval powers of the continent, or, say, £5,000,000 in excess of our own gross figures. But in the latter should be included the sum for naval works and certain amounts, not shown in the estimates, which are contributed by the colonies and India. The sum we receive from our dependencies is, however, not large, and the expenditure on naval works is somewhat uncertain, as it generally falls short of that estimated; for this year it is stated at £2,500,000. Sir Charles Dilke, probably our best authority on this point, has put down the naval expenditure for the present year at a round £30,000,000. The chief correction to the foreign figures is rendered necessary through the passing of the German navy bill by the Reichstag on June 12 last. This measure provides a continuous ship building program which will extend over a number of years. From what is known here of the actual figures as to cost, it would appear that the total expenditure of Germany for the present year would be about £8,500,000. That is over £1,000,000 less than the original proposal, as put forward by the German emperor and his advisers, the suggested amount having been cut down by the Reichstag during the passage of the bill through the house. The passing of the navy bill of Germany, therefore, adds roundly £1,000,000 sterling to the above aggregate for the four countries. The corrected totals would be, roughly, £30,000,000 for Great Britain and £34,500,000 for the four great continental powers.

Turning from the expenditure on warships to the trade the various navies have to protect, we find according to Lloyd's register of vessels of 100 tons and upwards, that the United Kingdom and the colonies owned in 1899-1900, 7837 steamers of an aggregate of 11,719,247 gross tons, and 3161 sailing vessels of 2,269,261 tons net, or 10,998 ships of 13,988,508 tons in all. France had 639 steamers of 997,235 gross tons, and 543 sailing vessels of 244,856 net tons; so that the total of ships for France would be 1182 vessels of 1,242,091 tons. Russian returns are a little uncertain, but the figures as given may be accepted as an approximate guide in absence of more certain information. Russia is therefore credited with 456 steamers of 392,985 gross tons, and 762 sailing ships of 250,542 tons net; or 1218 vessels of 643,527 tons in all. The German returns show 1133 steamers of 1,946,732 gross tons, and 543 sailing ships of 506,602 net tons; or 1676 vessels of 2,453,334 tons in all. Italy is credited with 282 steamers of 445,565 gross tons, and 868 sailing ships of 430,286 tons net; or a total of 1150 vessels of 875,851 tons. The total tonnage for the four countries named is 5,214,803, it being remembered that gross tons are taken for steamers and net tons for sailing vessels. As this is done for all countries, the results are fairly comparable, country for country, although the enormous preponderance of steam tonnage in the British returns must be noted as an important factor in the strength of our mercantile marine. On these totals—which our readers may correct according to their own views, for the question of steam and sailing tonnage is one open to much controversy—it will be seen that we own over two and one-half times the tonnage of the four countries named. Each pound sterling we spend on the navy guards not very far from half a ton of shipping (.466 ton), whilst each pound spent by the four foreign powers combined guards no more than 1½ tenths of a ton (.151); or, in other words, if we were to bring our navy estimates to an equality of the four powers combined, taking mercantile tonnage as a basis of expenditure, parliament would vote about £90,000,000 for the fleet yearly.

The above comparisons are only put forward as indications of the trend of naval policy; and there are many circumstances that would modify them in detail had we space to go separately into all the figures; for instance, there is the amount of shipping we build for foreign owners; but this is hardly a factor in the duties of our fleet. It must be remembered also that we are dealing only with naval expenditure. Our dependence on a navy is so much greater than is the case with any other power in the world that we must necessarily expend more on its maintenance. The ocean trade routes must be adequately protected in any case, and it rests with our manufacturers and merchants to show that enterprise in trade that will make the burden of keeping them open, great as it must be, not insupportable; that is to say, as the country necessarily increases its naval expenditure it should increase its revenue from trade. The position is a difficult one, with the nations of the world pressing ever more closely on our heels in the race for coming supremacy. Ten years ago (1890-1) our gross navy estimates were £14,500,000, about half our present expenditure; undeniably far too little; but our imports and exports then differed in total amount not greatly from those of the year with which we have been dealing.

The great increase in the navy vote and the absence of marked improvement in over-sea commerce, are not encouraging, with labor troubles checking trade, sensational financial swindles and rotten company-promoting paralyzing capital, our natural resources declining relatively to those of other countries, and foreign enterprise so often beating us in fields once exclusively our own. But vast as is the sum we spend on our navy, it is hardly necessary to repeat here what we have said so often—namely, that the expenditure is more than warranted by the magnitude of the interests that have to be safeguarded. Of course there are other functions for a fleet besides the protection of oversea commerce, but it must be remembered that exports and imports are of more vital importance to us than they are to any other country; therefore, the greater need for their adequate protection. Moreover, it should be borne in mind that if the army votes were included in the comparison the results would be very different; and further, an allowance should be made in our favor for compulsory service both in armies and navies abroad. We are, however, only dealing with the naval question at present.

It would be an interesting task to make a complete comparison of the various items or votes in the naval estimates of the different countries respectively; but, unfortunately, the detailed information at our command does not admit of this. There are, however, a few details which may be touched upon with advantage, even although headings or titles in estimates may not always mean exactly the same things in the different countries. The most prominent feature of all navy programs is that which refers to ship construction and maintenance of the fleet. In our estimates this is provided for in Vote 8, under which, in the present year's estimates, we find a gross sum of over £13,000,000 set apart for ships and engines. In order to obtain the ship and her guns complete—for the latter can hardly be separated from the former in a man-o'-war—we must include £3,000,000 odd provided in Vote 9 for naval armaments. We have, therefore, over £16,000,000 sterling in all to be spent on armed tonnage to be added to the fleet this year; and of this nearly £8,500,000 is for new construction in ships and engines. If we turn to the French estimates and select what appear to be corresponding subheads, we find nearly £6,500,000 as the estimated cost of producing the proposed tonnage for the year. The Russians apparently intend spending £4,800,000 on the same account.

It will be seen, therefore, that as our total expenditure on the navy largely exceeds that of France and Russia combined, we are also spending more than these two countries in addition to and upkeep of the fleet and its armament. It must also be remembered that we can build ships and engines more cheaply in England than they can be produced in either of the countries named, even although our splendid engineering resources are in certain directions somewhat neutralized by the pedantic methods pursued at the admiralty.

It is impossible to deal with the German figures satisfactorily, as the totals of the original estimates have been so altered by the passing of their navy act of last June. By the special ordinary estimates of the year, however, we find that a sum of over £2,395,203 is provided for the construction of vessels. To this should be added a little over £1,000,000 for "armaments and torpedo equipment," and £845,462 for "maintenance of the fleet." As already intimated, additions to these figures should be made on account of the navy bill, but to what extent is by no means clear. It is probable, however, that the expenditure of Germany on ship building and machinery will not fall much short of £4,000,000 sterling annually for many years to come. It is probable also that the large majority by which the navy bill was supported will enourage the German emperor to push forward still further a project that is so near to his heart, the enlargement of his navy.

It is interesting to note that the estimated completed cost of the French ships under construction in dock yards during the present year is £17,691,291, of which sum £2,646,618 will be spent during 1900. The estimated completed cost of French ships being built by contract during 1900 is £7,701,353, of which sum £1,529,793 is to be spent during this year. We may point out that the reason these latter figures, taken direct from the French estimates, do not agree with those we have already quotd is because we have included as part of the cost of a ship certain items which the French official compilers do not include. Our totals are made up so as to be comparable (as nearly as possible) with those of the British estimates. The year's program of construction for the royal navy divides the work fairly equally between the government yards and the contractors, there being a preponderance of about £400,000 on the side of the former. Doubtless, for the benefit of the taxpayer, it would be preferable for the balance to be the other way, but in any case the large sum spent in the private yards and engine works of Great Britain bears eloquent testimony to our great maritime resources, upon which alone the true greatness of a naval power can be permanently founded.

From the cost of ships and guns we may turn to the cost of the men behind the guns and down in the machinery compartments. For the pay of a total of 114,880 naval officers, seamen, boys, coastguard and royal marines needed during the present year, our admiralty ask the gross sum of £5,643,016; whilst victualling and clothing will absorb £2,186,175 more; or a total of over £7,829,191, leaving out medical and educational services. In the French estimates, navy pay and marines cost just over £2,500,000, whilst victualling and clothing are set down at £1,172,000 more, the exact total being £3,672,917. Russia sets apart for the pay of officers, seamen, etc., rather less than £500,000, whilst for victualling and clothing the sum provided is almost as much, namely, £430,072, making a total of something short of £1,000,000. The Russian seaman is by no means luxuriantly clothed, and probably is not more sumptuously fed than the men of other navies. It would appear, therefore, from the above figures, that very little goes to him in the shape of pay. We have not a record of the number of men provided; but the system followed of compulsory service naturally does not lead to anything like high pay. On the other hand, it should be remembered that though our own sailors receive a much larger proportion in pay as compared to victualling and clothing,

they spend a good deal of their own money on food and clothes. There is, no doubt, however, that the seaman of the royal navy is better off than his Russian brother; and, we should say from observation, is more than proportionately valuable. If we pay our seamen better we get more value for our money; and, further, if we would increase our expenditure somewhat by providing greater facilities for both officers and men to learn the duties that would be required from them in time of war, the outlay would repay itself tenfold. The German ordinary permanent navy estimates provide £879,638 for "military personnel," "victualling," and "clothing," but here again the influence of the navy act of this year will be felt.

It is in the non-effective services that the difference between our own naval policy and that of other countries is most apparent. In our 1890 estimates we have a sum of over £2,250,000 set apart under this section. Of this, £798,972 is for "half-pay, reserved, and retired pay;" for "naval and marine pensions, gratuities, and compassionate allowances" there is provided £1,145,550; whilst "civil pensions and gratuities" will cost £343,882. It is not easy to make a comparison of these figures with those of other countries, as the information is extremely vague. We are told that the French estimates provide £453,788 for "pensions" and the Russians £82,834 for "retired pay." The question of non-effective services has always been an open one in estimating the expenditure on the navy. Certainly pensions must be charged to the account of the fleet, as they form a legitimate part of the expenditure. On the other hand, so far as pensioners are not to be counted as effective for fighting purposes, their cost cannot be considered as an investment for the defence of the nation. As long, however, as the ratio of pensions to active pay remains fairly constant we may safely take the present system as a guide. Pensions are really deferred pay; and the sovereign we give one man today in the shape of pension we take from the pocket of the seaman afloat; who, when his turn comes, will receive a like benefit. In the case of a reduction in the personnel of the navy, the proportion of non-effective to effective pay would naturally have to be taken into consideration, otherwise total estimates—and the public mostly thinks in totals—might become misleading.

The vote for our own admiralty office is £276,100, whilst the French admiralty office is estimated at £132,986. The French have, however, a "construction staff," for which there is provided £195,440. How far this staff may carry out duties similar to those performed at Whitehall we are unable to say; but if we conclude they do, we must in fairness add to our admiralty vote the £81,185 provided for "scientific services." The Russian navy estimates appropriate the sum of £237,014 for "central and ports administration," which appears to be equivalent to our admiralty vote. The Imperial naval office of the Germans is put down at only £63,743 in the ordinary estimates for the year.

COAL EXPORTS AND OCEAN SHIPPING.

From the Iron Age.

The hope is entertained that the long desired revival of the American merchant marine may be hastened by the rapid growth of our coal export trade. The increase in this trade with European countries is phenomenal. According to the bureau of statistics, our export of coal to all Europe in the calendar year 1899 aggregated but 35,322 tons, whereas in the first eight months of the present year the quantity sent to the same destination was 375,761 tons. For the month of August alone the figures were 97,189 tons, or 175 per cent. more than for the whole of the year 1899. It is asserted by coal interests that the movement to Europe would be much larger if freight room were available. They are unable to take complete advantage of the favorable conditions abroad for shipping American coal by reason of the limited facilities afforded for this class of transatlantic business. So much shipping has been diverted to other parts of the world to meet military exigencies that the transatlantic mercantile marine is at last inadequate for the traffic offering. Our iron and steel export trade has for some months been checked by the scarcity of available shipping and the accompanying high freight rates, and for some time the coal export trade has been another and perhaps stronger influence in making freight room hard to get and preventing freight rates from dropping to reasonable figures. We have seen the time when foreign tramp ships were so abundant that many of them were tied at docks in the principal ports waiting for cargoes, but the necessities of war and the increasing commerce of the world have given them all continuously profitable employment. The cry now is for more ships, and this cry seems to come loudest from our own people.

The conditions certainly seem to be more favorable for building American ships for the foreign carrying trade than have been experienced for half a century. One by one the obstacles have been removed or the necessary favorable influences have developed. We have a deficiency in the supply of ships for the world's traffic and a steadily growing export trade in American products of almost every description as the fundamental elements of the proposition. Other essentials in the work of reestablishing our ancient position in the world's carrying trade we undoubtedly possess, such as an abundant supply of ship building materials available at low cost, an ample force of skilled workmen capable of performing all the work required in building ships, an increasing number of men trained in designing ships and operating ship yards, and a vast amount of unemployed capital seeking investment. All that is now required is the confidence of capitalists in the financial returns to be obtained from ventures in ship owning. If they can be satisfied on this point it may be expected that steamship companies will be formed to engage in our foreign carrying trade on a scale commensurate with other American commercial undertakings. From time to time we hear of a contract being placed for a vessel or two designed to engage in this trade. Only lately announcement was made that the Maryland Steel Co. had received an order for two large cargo carriers. But the movement so far has been very slow. It needs much more impetus to enable the United States to take at an early day the place it should occupy in ocean navigation. Considering the position of this country in supplying the needs of the world, its merchant vessels should outnumber and outclass those of any other nation.

Some great force is almost always needed to start the energies of a people in any particular direction. It has been claimed that less force is necessary with Americans because of their adventurous spirit, which leads them to make hazardous commercial risks. But in the matter of engaging in the ocean carrying trade they have been conspicuously conservative. They have seen their country's foreign commerce grow steadily from year to year, sometimes making great bounds, but never falling back, and all the while enabling the shipping interests of other countries to thrive, until some of the navigation companies thus built up are among the greatest commercial enterprises of the age. As these great enterprises have failed to invite serious competition from American capitalists, it would seem that at last pressure is to be applied by American freight seeking an outlet. If the coal trade proves to be the potent factor in diverting American enterprise and energy to the upbuilding of an American merchant marine, the country will be a much greater gainer than from the mere increase in its exports through sales of coal abroad. In this question the iron and steel trades have a vital interest.

CORROSION OF BOILER TUBES.

An excellent paper on this subject by Commander Walter F. Worthington, U. S. N., in the Journal of the American Society of Naval Engineers, deals with the experience obtained in the United States navy. Mr. Worthington calls attention to the difficulty of drawing conclusions of any value from the ordinary records of various ships. The extent to which the various boilers are actually used is an important factor, also the service in which a ship is employed, and the part of the world in which she has cruised. Some commanding officers and chief engineers are desirous of maintaining their boilers in a high state of efficiency, while others are anxious to keep down the cost of maintenance. When salt water has been permitted to enter the boiler the scale, although reducing the capacity of the boiler, and being dangerous to the combustion-chamber sheets and furnace crowns, has the effect of diminishing corrosion. Different kinds of fresh water also have different degrees of corrosive effect, and the conditions are so different in different cases, as to render it almost impossible to obtain comparable results.

For the above reason it is undoubtedly advisable to look elsewhere than to naval records if we wish to learn anything about the corrosion of boiler tubes. Instead, Mr. Worthington examines the various causes to which corrosion may be due, and takes them up seriatim, in connection with such reliable experiments as may be available. The usual reasons given for the corrosion of boiler tubes are as follows:

1. Fatty acids from decomposition of animal or vegetable oils.
2. Hydrochloric acid, due to the decomposition of the Mg Cl in sea water at a high temperature.
3. Galvanic action.
4. Use of salt water.
5. Presence of carbonic acid in water.
6. Presence of air in water.

Since only mineral oils are used in vessels of the United States navy, it may be safely assumed that the first cause is absent. Experiments in connection with the liberation of hydrochloric acid by the decomposition of magnesium chloride, have shown that while this is possible, the acid is always immediately appropriated by some base other than the boiler metal. If the corrosion in any case were due to hydrochloric acid, chloride of iron would be found in the boiler water, and this has not been done.

Galvanic action may be due to the different position on the electrical scale of clean iron or steel and mill-scale, since experiments have shown that when plates, which have not been freed from mill-scale are connected galvanically with plates free from mill-scale, an electric current, capable of being measured with a galvanometer, is set up. Corrosion from this source can only be prevented by removing the mill-scale from the water side of the tubes, or by using only seamless tubes, which are thoroughly pickled during the process of manufacture, and have no scale left on when completed, and by substituting galvanized steel or iron for brass internal feed pipes.

Sea water is known to be a better solvent of steel and iron than fresh water, and is also objectionable on account of the formation of scale. Fresh water should always be used, unless in cases of great emergency, and if it was used exclusively galvanic action would be out of the question. All fresh water is not desirable, however, since the presence of organic matter is apt to cause the production of carbonic acid, enumerated under the fifth head above as a corrosive agent. Carbonic acid has been demonstrated to be an important factor in corrosion, not only because of its own direct action, but because it acts as a carrier for oxygen, and a very small quantity is sufficient, since it brings the oxygen into combination with the iron, itself not being used up in the operation. It is impossible to detect by litmus the presence of the small proportion of carbonic acid sufficient to cause this effect, and the only thing to be done is to test the water for organic matter, observing whether or no it is darkened by the addition of hydrosulphuric acid. As it is often impossible to choose the water which may be offered, the proper remedy is to provide sufficient evaporator capacity to render the vessel independent of outside sources of supply.

Air in water can only be removed by prolonged boiling, but in Mr. Worthington's opinion the presence of zinc has a considerable effect in neutralizing the oxygen. "The tubes of our boilers may be made to last longer in the future than they have done in the past," he says, "if engineers will be governed by the following rules, which have heretofore been more honored in the breach than in the observance: Allow no tube or plate to enter the construction of the boiler with mill-scale on the side in contact with the water. Use galvanized iron or steel instead of brass for internal feed pipes. These may rust out, and should be made easily renewable. Provide evaporator power enough to insure a sufficient supply of fresh water, so that it will never be necessary to use either sea water or fresh water of doubtful quality from shore. Provide fresh water reserve tanks, so that the boilers will never have to be used as storage tanks. Keep all boilers closed, the water at a constant level and above the tubes, and, by use of caustic soda or caustic potash, at all times sufficiently alkaline to turn red litmus paper blue. Use zinc plates of the standard size, 12 by 6 by 1 in., distributed beneath the surface of the water. Finally, keep the temperature of the feed tank up to nearly boiling at all times. After all this has been done by the engineer there still remains the problem for the tube manufacturer to furnish tubes of some material less corrodible than iron or steel, and above all, to produce tubes more uniformly corrodible. At present a lot of tubes are put into a boiler, side by side, under identical conditions in every respect. One of them will corrode through in six months and another in six years."

MARINE REVIEW

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The breaking of the starboard tailshaft of the steamship St. Paul and the consequent loss of her starboard propeller has revived interest among marine engineers in the subject of shaft failures. Notwithstanding the researches into the subject and the safeguards that are adopted, screw shafts continue to break. It is nowadays one of the most common forms of accident at sea. Every little while one reads of the replacing of a shaft at sea through the skill and indomitable energy of the chief engineer. At a recent meeting of the Institute of Marine Engineers in London an interesting discussion was held on the subject of propeller shafts and the causes of the various failures that occur from time to time. The discussion related mainly, of course, to cargo carriers. One of the members dwelt strenuously upon underloading as a cause of shaft failure. He stated that the very light trim in which steamers were often sent across the Atlantic, and the hammering and battering their shafts were subjected to in consequence, was of late responsible more than ever for a great number of the failures which occurred. Some of the English technical press coincide with this view and have shown by statistics that underloading is a very potent factor in producing shaft failures and causing steamers to cast their propellers. Underloading, of course, cannot fail to put sudden and unnecessary strains upon the machinery by the frequency with which the propeller would be cast out and into the water. It adds an avoidable burden to the engines. Of course a propeller may fan wind and churn water alternately a thousand times without damage; but a shaft is no stronger than its weakest tension and flaws in steel are not always discoverable. There is always the danger of an unknown breaking strength. Indeed breakages of screw shafts and disablement of propelling machinery from various causes have become so frequent of late as to raise the rates of insurance and to cause inquiry among ship owners as to what changes in hull and engine construction may be devised to remedy the trouble. It is an important and fruitful theme for the constructor and engineer. Moreover it would be to the interest of naval architecture and marine engineering if the fullest possible information could be obtained as to the circumstances attending the breaking of shafts in order that well-defined and given causes may be minimized or avoided. Mankind progresses through its blunders; and the great inventions are all the result of accidents.

The election is over; the complexion of the house and senate and the executive is assured for four years more. No legislation of a disturbing kind is contemplated and none can be executed. The questions of tariff and finance are sealed. Uncertainty is eliminated from the situation. Everyone knows what to expect. There is no obstacle in the pathway of commerce. Never was the time more favorable than now for the passage of the shipping bill. The political element is removed. If the bill is passed at once its beneficial effects will have established its favor before another general election rolls around. There is really no reason why the bill should not pass at the forthcoming short session of the present congress. All arguments pro and con are in. Nothing can be added and nothing taken away. Senate and house bills are practically identical. The same committees which reported both of them still exist. The bill should be re-introduced at once and pushed to a conclusion. It is necessary for the restoration of the American merchant marine. There is no reason why the enormous profits of ocean carriage should go to Great Britain when a judicious expenditure of a little money will make the tide turn the other way. Through the possession of vast natural resources and an inborn ingenuity the United States has become the leading nation in manufactured exports. The bulk of it—all of it except 9 per cent.—goes abroad in foreign ships, because the United States has never been able to rehabilitate its merchant marine, which was destroyed in the civil war. A little help now and in a few years the American merchant marine will seek favors from none.

One listens with an ill-concealed impatience to the stories of the revival of sailing days. But why not? Has steam eternally banished sails from the ocean? Freighters are getting larger and larger and the economy of the marine engine is a science. But notwithstanding this the sailing ship is indisputably in possession of various routes of trade. For those deliveries in which time is no object it is the most economical transport. No matter how cheap fuel may become wind is cheaper. In fact it is likely to become more expensive from year to year. There is no exhaustion in the European supply but the veins are growing deeper and deeper and are constantly costing more and more to mine. This condition cannot fail to increase the operating expense of steam vessels. On the other hand it is only the excessive price of English coal that permits American coal to be landed in steam carriers at a profit in the European market. Is there not a legitimate field in the coal carrying trade for the sailing ship with just sufficient auxiliary machinery to handle its cargo, to propel it slowly in a calm, to give it steerage way in a storm and to work its way in and out of harbors without the use of a tug? This field is suggested because there is a present European market for American coal if the cost of freight can be brought low enough. There are already other trades in which the sailing vessel, equipped with some steam power, can hold its own. It would seem as though the day of the sailing craft is by no means done.

It is to be hoped that the bloodless, though none the less distressing, battle of the typewriters will not be waged between T. F. Newman, representing the City of Erie, and A. A. Parker, representing the Tashmoo. What the public wants to see is a race between the steamboats and not a rhetorical contest between their representatives. Already enough ink has been spilled between them to print a magazine. There has been much adroitnes of phrase, a suggestion of a hidden condition unfulfilled and the usual prelude to a fearful battle of words. But what the public wants is a race. As it stands Mr. Parker seems more anxious than Mr. Newman to gratify that desire.

Gen. Wilson, chief of army engineers, makes another plea in his annual report, made public a few days ago, for a general resurvey of the great lakes. He says that present conditions of commerce demand that the bottom of the lakes be accurately charted to depths not less than 30 ft. in the open lakes, or 25 ft. in their connecting rivers or straits, and these depths should refer to "low water" stages, instead of the "mean" stages now reported. This will call for extensive surveys and a vast quantity of office work, all of which must be done with great care and accuracy. He asks for $250,000 for beginning this work and continuing it during the fiscal year 1902.

The National Association of Manufacturers, Philadelphia, has issued the third edition of the American trade index, the descriptive and classified membership directory of the association. The edition is printed in English and French and 7,500 copies are now being distributed gratuitously among the principal business houses of the world. The American trade index is a valuable agency for the foreign distribution of information concerning American manufacturers. As the book is designed for foreign circulation only, a charge of $5 per copy is made in the United States.

SHIP BUILDING DURING OCTOBER.

The bureau of navigation, treasury department, reports that 112 vessels of 38,562 gross tons were built in the United States and officially numbered during the month of October, 1900, as follows:

	WOOD.				STEEL.				TOTAL.	
	SAIL.		STEAM.		SAIL.		STEAM.			
	No.	Gross.	No.	Gross.	No.	Gross.	No	Gross.	No.	Gross.
Atlantic and gulf	52	8,474	16	659	1	1,120	6	12,690	75	22,943
Pacific	8	3,713	3	555	....	.....	1	1,584	12	5,852
Great lakes	....	.....	....	.....	....	.....	5	8,534	5	8,534
Western rivers	11	182	8	489	....	.....	1	562	20	1,233
Total	71	12,369	27	1,703	1	1,120	13	23,370	112	38,562

The largest steel steam vessels included in the foregoing list were the American, 5,591 gross tons, built at Chester, Pa., for the American-Hawaiian Steamship Co.; Sierra, 5,989 gross tons, at Philadelphia, for the Oceanic Steamship Co.; Howard L. Shaw at Detroit, Mich., for the John Shaw Transit Co. The steamer Norfolk of 2,674 gross tons, a rebuilt foreign wreck, was also added to the United States merchant fleet.

MACHINERY OF THE NEW BATTLESHIPS.

The new United States battleships, Nos. 13 to 17 inclusive, which are to have a speed of at least 19 knots an hour on a displacement of about 14,600 tons unsheathed, or 15,000 tons sheathed, will have twin-screw, four-cylinder, triple-expansion engines of 19,000 I.H.P. The cylinders will be 35, 57, 66 and 66 in. diameter by 48 in. stroke. The designed revolutions are 120, which give a piston speed of 960 ft., and the steam pressure at engines 250 lbs. There will be two main condensers, with 23,750 sq. ft. of cooling surface all told, and three auxiliary condensers with 2,400 sq. ft. collective cooling surface. Each vessel will be fitted with twenty-four water tube boilers of the large, inclined straight-tube type, such as Babcock & Wilcox, Niclausse and Belleville boilers. There will be six fire rooms and four steam generators in each fire room, three lofty smoke stacks being fitted. The boilers will have an aggregate grate surface of 1,280 sq. ft. and 55,000 sq. ft. of heating surface, the working pressure being 265 lbs. Twelve forced draft plate blowers with double engines will be fitted, sufficient to give 1-in. air pressure with closed ash pits. The usual pumps, engine room auxiliaries, repairing tools, evaporators, distillers, dynamos, feed heaters and filters, refrigerating machines, etc., will also be fitted.

SEA LIGHTS THAT LIVE.

Almost everyone who has ventured on the never surfeited sea must have noticed the occasional brilliant displays of phosphorescent light afforded by minute living creatures on its surface. The wake is not infrequently defined as clearly in this way as though the ship herself were a huge lump of phosphorus, driven through a yielding body possessing a definite amount of friction. In a steamship, more especially, the globe-trotter has many an opportunity of witnessing such a never-to-be-forgotten exhibition of the workings of nature. Every sea that breaks on board occasionally appears as though it were a cascade bearing innumerable miniature electric lights, and each wave crest is distinctly indicated by the phosphorescent glow, due to the presence thereon of countless tiny sea creatures. As Shelley sang:

> "While the surf, like a chaos of stars, like a rout
> Of death flames, like whirlpools of fire-flowing iron,
> With splendour and terror the black ship environ,
> Or like sulphur-flakes hurled from a mine of pale fire
> In fountains spurt over it."

Allowing a little for poetic license, or what Jack would term "coming up," Shelley's description of a phosphorescent sea is not so very far removed from sober fact. That celebrated American shipmaster, Capt. S. Samuels, who brought the Dreadnaught from Sandy Hook to Queenstown in 9 days 15 hours, thus making the sailing ship record, has given, in his autobiography, a vivid word picture of his experience at Java. Men-of-war boats towed out to sea the good ship then commanded by Capt. Samuels. One hundred voices kept tune, while as many oars kept time. The oars seemed to dip into molten silver, and, as they rose, myriads of diamonds appeared to drop from them. To enhance the enchantment of the scene, the many sharks which abound in those waters darted hither and thither, leaving streaks in their wake which were only comparable to forked lightning. In those days there was time for a full appreciation of the romance of the sea. Sir Wyville Thomson, during the cruise of H. M. S. Challenger, found it quite an easy matter, when off the Cape Verdes, to read the smallest print in his cabin solely by the light emitted by the tiny sea creatures churned up by the ship. Her wake was simply a blaze of phosphorescence. At Pabellon de Pica, on the west coast of South America, some very luminous sea surface displays are experienced by vessels at anchor in the bay. During the day the surface water alongside appeared to be of a dirty purple color, although quite colorless in a glass. Every night for quite a week, without intermission, the sea surface was so brilliantly phosphorescent that the time could readily be determined by its aid from a watch, and the ship's names on their sterns were plainly visible to passing boats. Turning now to another part of the world, a reference to a log book shows a precisely similar result. Not far from Shanghai the sea surface was extremely phosphorescent; the light was vivid enough to permit of moderate print being read in the flashes, although the night was otherwise very dark. Outside Aden bay a species of luminous vapor appeared to linger tremulously on the sea surface. The belt was about 300 yards in length, and connected with very luminous water to the eastward. Probably this semblance of vapor may be rightly attributed to an optical illusion, and the cause sought for among the luminous little creatures of the sea surface directly beneath. At times the sea surface is like a vast heaving mass of metal at white heat, rather than an abiding place for tens of thousands of tiny points of light. If anything, this form of luminosity is the more awe-inspiring. Off the entrance to the Persian gulf the sea suddenly became smooth. In one short hour the whole horizon seemed gorgeously illuminated. Shortly afterwards, the vessel entered a large area of water of most dazzling brilliancy; the sea was exactly similar in appearance to quick silver and the propeller churned up water which looked like milk. A bucket of water drawn from over the side seemed quite clear, but some placed in a bottle plainly indicated the presence of countless animalculae. Just eastward of Socotra a similar experience is not uncommon. Oft there a steamship commanded by Capt. J. McKirdy, R. N. R., now marine superintendent of the Shaw Savill & Albion Co., ran into a large patch of water which looked as white as milk. Although the night was dark a vessel's starboard light of green would have been difficult to pick up under its influence. Half way between Socotra and Colombo a sailing ship had the sea surface suddenly assume a milk white appearance at night, without a sparkle. Next night the curious creatures again made themselves similarly manifest. She seemed to be sailing through an extensive meadow covered with a spotless sheet of snow. Within an interval of a few hours, over 100 flying fish came on board, and were picked up by the crew. Apparently the ocean area thus affected was an approximate square of four degrees side. Occasionally the sea is phosphorescent, while at the extremities of masts and yards are examples of electric discharge known as corposants. Some years ago the Wisconsin, when near Sandy Hook, experienced a terrible thunderstorm. At each masthead and yardarm there flickered a corposant of remarkable splendor, and all around, as far as the eye could reach, the sea appeared to be a million dimples of liquid, shining silver. Not infrequently, if a tumblerful of luminous water be kept in a dark room for some hours, and apparently phosphorescent properties have departed from it, they can be renewed with less effect by agitating the water with the fingers. Sailors are seldom provided with microscopes or Latin dictionaries. Hence it is worse than affectation, it is a downright fraud on a confiding public, to boldly rush into print with a detailed description of the appearance and family of the tiny sea creatures which give rise either to the display of myriads of points of light, or to the even more effective glow like molten metal. On one occasion, when the ship's wake looked like liquid fire, the sea was found to contain some substances about three inches long, of oblong shape, and resembling the electric light in color. This occurred a little to the northeast of Rio Janeiro. When near St. Paul's island the sea was luminous in patches, and a bucket of water drawn from over the side readily revealed the cause thereof. Several strips of blubber-like substance, eight inches in length, and having a central canal from end to end, were well in evidence. On taking these peculiar people of the deep sea into a dark room they made it so vividly illuminated that the time by a small clock could be clearly determined without the aid of any other light. Some suppose there are not animalculae present where the color of old ocean is blue, and consequently phosphorescence cannot then exist. Others believe that a phosphorescent display is the forerunner of a storm. As a matter of fact, blue water is luminous, and fine weather frequently follows a display. Any description nearer than this is out of place except in a treatise by a scientist of repute.—Syren & Shipping.

IRON AND STEEL IN SCOTLAND—SHIP BUILDING INDUSTRY.

Glasgow Correspondence in Iron Age.

The iron and steel trade of Scotland is in a peculiar position just now, situated, as it is, between the devil of high costs and the deep sea of foreign competition. As yet American pig iron has not found its way to any extent to the Clyde, which is the largest ship building center in the world. But American steel ship plates have; and in consequence of the heavy arrivals and forward contracts of American plates the Scotch makers have had to reduce their prices to a level which they declare to be wholly unremunerative at the prevailing costs of fuel and of crude iron. The nominal price of Scotch ship plates at the date of writing is £8 per ton, less 5 per cent., say £7 12s. net. But as a matter of fact makers are not selling at these prices, and merchants have contracted to deliver at £7 5s. net, in sure and certain hope of being able to cover at a fair profit later on. What the Scotch ship builders are now mainly working on—at all events those of the Clyde district, which is handy for imports by sea—is American material, which has been sold down to £7, and for forward delivery at even under that figure, delivered at ship. It is sufficiently curious that Glasgow, which supplied the plates for the first vessel built of steel in the United States, should now be able to revive its ship building industry by means of American steel. For it was the high price of plates, raised by local makers some £2 10s. per ton within a twelvemonth, that checked the demand for new vessels, even while the demand for tonnage was great and freights were high. Between 1897 and 1900 the cost of construction of a high-class steel steamer increased about 70 per cent. at the extreme prices; but at present the difference cannot be more than 35 per cent. Hence the ship builders are now booking more freely, and are full of work that will keep them actively employed well over next year, while it is known that there are a good many orders for merchant steamers and for the royal navy still to be placed.

But the improved and improving condition of the ship building industry has not improved the Scotch iron trade. The demand for finished iron and steel in all other branches of consumption save ship building seems to be steadily declining with the shrinkage of trade all over the world. And Scotch manufacturers are handicapped in pursuing retreating business by dear pigs, dear coal and high wages. Scotch smelters do not burn coke in their blast furnaces, but a special quality of splint coal. Most or all of them are coal owners, but most of them have to buy from other coal owners a large portion of the splint coal they consume. The special quality required for the furnaces is found only in a few pits, so that practically the supply is in the hands of two or three firms. They make the price—not the consumers—and they have made the price so high this year that iron smelting in Scotland must have left a dead loss at times but for the utilization of the by-products of the furnaces for which good prices have been obtained. For several months past the price of furnace coal has been kept at 15 shillings per ton, at the pits, or just about double what it was before the great rise in coal began. On the basis of two tons of coal to the ton of iron smelted, this alone means an addition of 15 shillings per ton to the cost of producing pig iron. From normal prices the advance is about 20 shillings per ton. Then, all the hematite ore for the Scotch furnaces has to be imported, chiefly from Spain, and the advances in ore and in freights have added still more to the cost of pigs.

Latterly smelters have been still further bothered by the exaggerated alarm of the Spaniards at the occurrence of a few imported cases of so-called "plague" in the harbor of Glasgow. The imposition of quarantine on ships from Glasgow has greatly interfered with the shipments of iron ore from Spain to that port. However desirous smelters may have been, therefore, of helping manufacturers with cheaper raw material, although there is no reason to suppose that iron smelters are any less disposed than other people to make all they can, they in turn are severely handicapped.

The Germans have been large and eager buyers of British pigs (chiefly from Middlesbro-on-Tees, however) all along, but latterly their demands have fallen off greatly, partly because of reduced consumption in their works and partly because of the shipments of American pigs. Indeed, Germans have been reselling in the Middlesbro market hematite pigs bought there in past months for autumn shipment to Germany. The trouble is, moreover, that while Germany is now buying less British pig iron, she is beginning to compete actively again with British iron and steel makers, and is also pressing so hard upon Belgian makers that they are driven in turn to compete frantically for foreign business. And thus it is that the British markets are becoming overwhelmed with American, German and Belgian materials at prices which British makers cannot touch, and which are doubtless leaving the German and Belgian competitors with heavy losses.

The Scotch iron trade is so largely dependent on ship building that it ought now to be in a fairly prosperous condition. But it is not, for the reasons which have been stated. American bars have lately been delivered right into the new heart of the Scotch malleable iron trade (Coatbridge) at prices below what local dealers would or could sell at. Tube making is a large trade in the west of Scotland, and American strips have undersold local makers there. And so on. It may be that the prices at which these parcels of American goods are sold leave no profit on the cost of production and transport. And it is doubtful if the business can be a continuous and permanent one. But it is enough in the meantime to bring Scotch producers to the choice of selling at a loss or closing down works. And as a matter of fact works have been slowed down pretty nearly all round, though in few cases has absolute stoppage been necessary. Until recently trade has been very prosperous, and has had a long term of healthy activity, with, of course, a fair supply of running contracts left over.

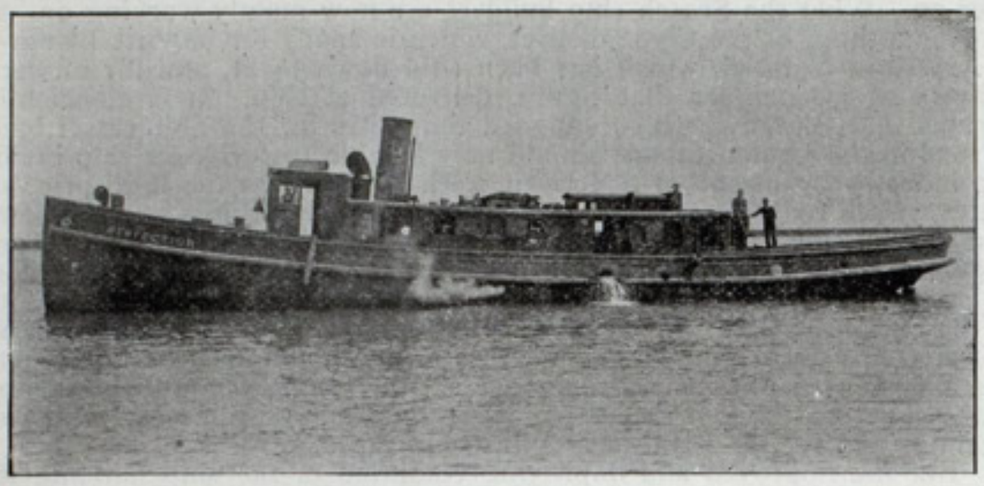
The Puget Sound Bridge & Dredging Co., Seattle, Wash., has secured the contract on its bid of $26,670 for the construction of the wharf at the Puget Sound naval station.

FUTURE OF THE TURBINE ENGINE.

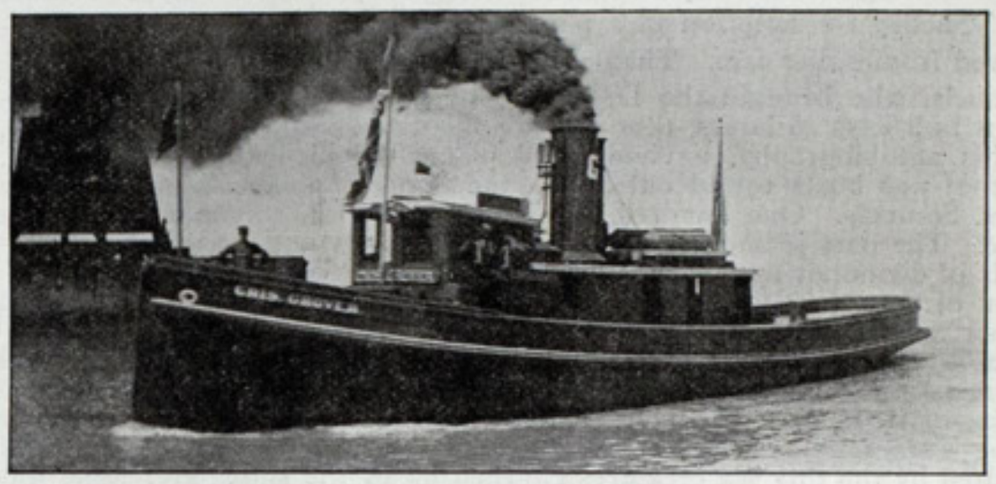
DISCUSSION INTENDED TO SHOW THAT IT MAY BE APPLIED TO SHIPS OF SPECIAL HIGH-SPEED SERVICE, BUT NOT TO THE VARYING SPEED REQUIREMENTS OF VESSELS OF WAR.

A discussion of some interest has recently taken place between Mr. Parsons and Mr. Thornycroft concerning the relative merits of the torpedo boat Viper, which has attained a speed of 36.858 knots, with turbine engines, and the Albatross, constructed by Messrs. Thornycroft & Co., which has a speed of about 31 knots. It appears that at less than full speed the turbine is not economical, and in practice it is found that while one ton of coal will take the Albatross 22.6 knots, the same quantity will take the Viper a little less than 12 knots, the speed in both cases being 15 knots. For the moment we are not concerned with that branch of the controversy which deals with the merits and demerits of these boats for fighting purposes. It may be argued that, as torpedo destroyers are after all not well fitted for cruising, one with a very high speed for a spurt must be better than the slower boat which can keep the sea longer. Our purpose now is to consider why the turbine engines should be less economical at slow than at high speeds.

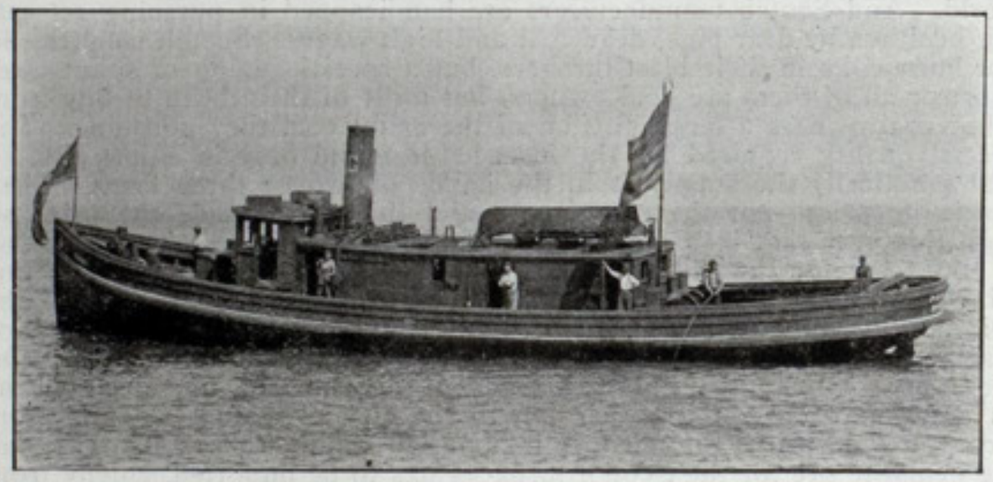
In its construction the steam turbine closely resembles the water turbine. There are vanes which move and guide blades which remain at rest. It is important to bear in mind that in both these machines there is at all times a clear passage right through the wheels. There is nothing to arrest the flow of either water or steam through them. The effect of this is that if we block a water turbine so that it cannot revolve, nearly as much water will flow through it as if it was at work. If we block the revolving drums of a Parsons turbine the steam will flow through, almost as fast as if it was revolving. If we take the water turbine and examine it when blocked, with the water passing through it, it will be seen that the water leaves it at about the same velocity with which it entered it. When revolving it leaves it at a much smaller velocity. In some turbines the quantity which can be passed through the blocked wheel is actually greater than that which will pass when the wheel is working. Precisely the same statements hold good of the steam turbine. Theoretically a perfect water turbine would deliver the water at no velocity; of course, such a condition is a practical impossibility. Without touching on the mathematics of the subject, which are of small practical value for our present purpose, it may be said that there is a velocity for the rotating wheel which is better than any other velocity, higher or lower. The greater the head, the faster must the turbines run, and, broadly speaking, it may be said that the best economical result is obtained when the velocity in feet per minute of the revolving wheel is about one-half that of the water. Now, in the steam turbine there is a speed which bears a close relation to the maximum efficiency, and this speed is very high. In order to make the facts clear, we may use a simple illustration. Let us suppose a number of balls to fall from a height on a movable inclined plane. The balls move vertically. If, now, the inclined plane is drawn back, base first, sufficiently fast, the balls will continue to move vertically, and will exert no pressure on the plane. If, on the other hand, the plane is held fast, then the balls will exert an effort on the plane, tending to drive it back, and they will themselves be deflected toward the toe of the plane and will roll down it. The problem is to take as much as can be taken out of the balls in the shape of the driving effect on the plane; and to this end the plane must move at a speed which bears a definite relation to its angle of inclination and the path of the balls. We may with strict propriety consider that steam as made up of myriads of little balls moving at a very high velocity, and the inclined planes, or their equivalent the vanes of the Parsons turbine, must also move at a very high velocity in order that the vis viva of the steam may be transformed into torque energy with the least waste. In the steam dynamo there is a constant reversal of the direction of the current, but with this we need not further concern ourselves. In any case, the steam must escape with some remaining velocity and momentum, and this is waste. If the machine runs too slowly, steam will to all intents and purposes pass through it without doing any work. On the other hand, if it runs too fast, the steam will again flow through it without doing any work. We come back to the starting point. There is a velocity which is better than any other, and, indeed, so much better that any departure from it is productive of great loss of efficiency. As the speed depends on the velocity with which the steam moves, it may be thought that by reducing the pressure of the steam, and thereby its velocity, less power can be got without loss. This is no doubt true to a certain extent; but it cannot do much in practice, because the velocity of flow of steam does not vary directly as the pressure, but as given by the formula, $v = 3.5953\sqrt{h}$, where v = the velocity of outflow in feet per minute for steam of the initial density, and h the height in feet of a column of steam necessary to give the pressure. To illustrate the bearing of this formula on the question discussed, we may say that, according to Brownlees' classical experiments, while steam of an absolute pressure of 30 lbs. on the square inch flows into the atmosphere at a velocity of 1,401 ft. per second, steam of 100 lbs. pressure has a velocity of 1,459 ft. per second. From which it will be gathered that the speed at which a turbine is most



PERFECTION, CHICAGO. COMPOUND ENGINES, 14 AND 28 X 24 INCHES.



CHRIS. GROVER OF LORAIN. ENGINE 22 X 24 INCHES.



PRODIGY OF CHICAGO. COMPOUND ENGINES, 15 AND 30 X 26 INCHES.

ERASTUS DAY OF CONNEAUT. ENGINE 22 X 24 INCHES.

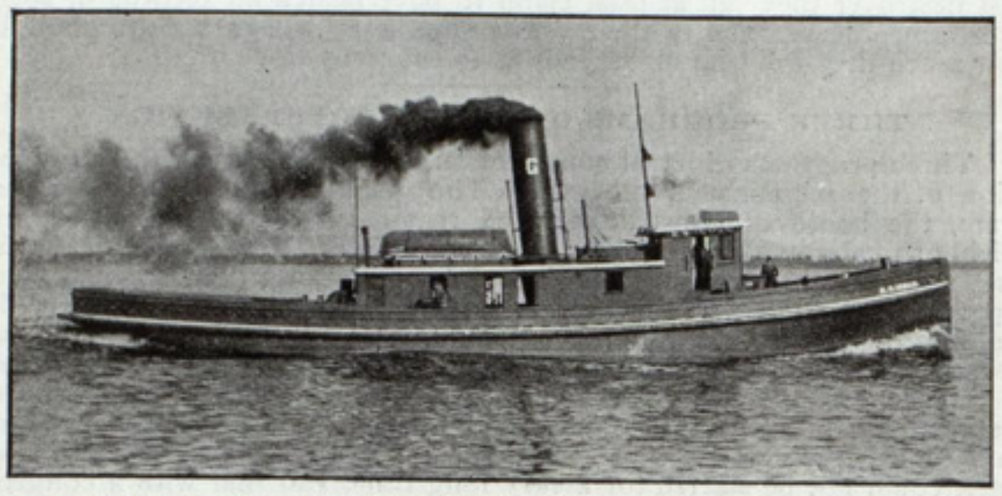
T. T. MORFORD OF CHICAGO. ENGINE 24 X 28 INCHES.

ANNIE OF FAIRPORT. ENGINE 24 X 26 INCHES.

Harbor Tugs—A few of the Great Lakes Towing Co.'s Fleet.

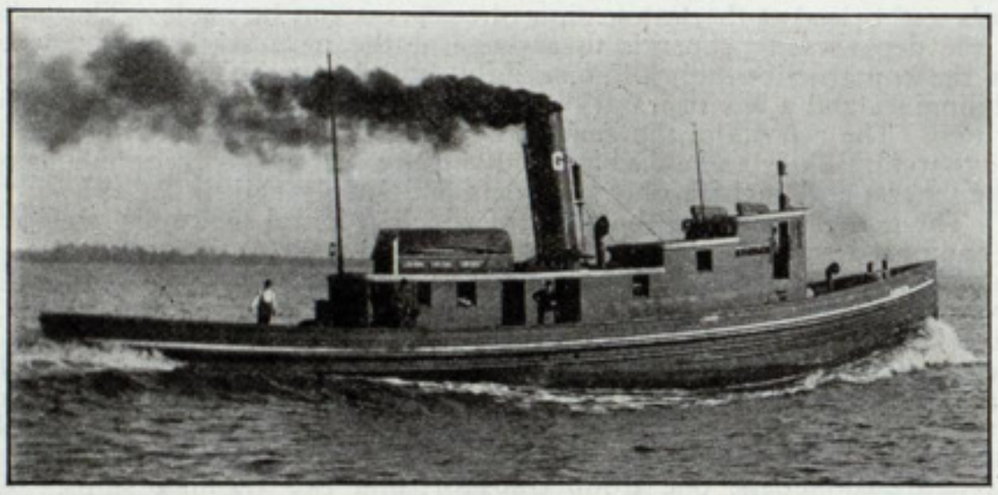
efficient is very little affected by the boiler pressure. In other words, the low-pressure turbine will have to run nearly as fast as the high-pressure turbine. Certain conditions modifying this come into play, no doubt, but the fact remains unaltered, that any considerable departure from the speed of maximum efficiency results in a greatly increased consumption of steam. This is one principal difference between the engine built by Mr. Parsons and that made by Mr. Thornycroft. Lastly, in this connection we may say that the comparatively moderate consumption of steam in the Parsons engine—20 lbs. or so per brake horse power per hour—is due to the way in which the steam is used, because of which initial condensation is reduced to a very small amount. In a word, steam remains steam in the Parsons engine to a greater extent than it does in the reciprocating engine.

So far we have only dealt with the turbine engine as an engine. We have now to consider its efficiency when combined with a screw propeller. It will be readily understood from what we have said that the velocity of the moving vanes in feet per second must be very high. In the United States many patents have been taken out for engines in which a moderate speed of rotation is combined with a high angular velocity of vane, by making the diameter of the wheel large. But this cannot be done in torpedo destroyers with moderate draught, say, 7 ft. The result is that the rate of rotation of the screws reaches 2,500 to 3,000 revolutions per minute. The compulsory result is that the pitch of the screw must be extremely fine. But a fine pitch always means that the surface velocity of the screw must be very high if the boat's speed is high; and another direct consequence is that the loss of power due to the surface friction in the water of the propeller is great. Here, again, we have the peculiar case of a certain velocity of maximum efficiency, to say nothing about cavitation or a cutting of a partial vacuum, so to speak, in the water. We have a speed, and surface, and pitch, which are better than any others; and it is admitted very readily by Mr. Parsons that the surface or blade area of screw which is correct for the maximum speed of boats is much too large for low speeds. It is well known that for all steamships there is a speed of engines and ships which is more economical than any other speed, but with reciprocating engines running at moderate speeds—anywhere, that is to say, between sixty revolutions for a tramp and 300 revolutions for a torpedo destroyer—there are wide margins, vibrations within which will very little effect the result. Thus, for example, a torpedo destroyer, running at 10 knots, will probably burn less coal per horse per hour than will be used when she is running at 20 knots, a good deal less when she is running at 30 knots, but even then the differences are not large. With the turbine, however, the case is different. With such a boat as the Viper it is all or nothing. At extreme speed she may beat the reciprocating engine also at extreme speed in coal consumption per horse per hour; but at any other speed the turbine loses and at half speed or thereabouts economy goes to pieces. Not only is the engine wrong, but the propellers are wrong. We do not for a moment contend that this fact is one greatly to the detriment of the turbine engine. Nothing of the kind. The only effect that a fixed and extremely contracted relation between speed and economical efficiency has is that it narrows the limits of application of the turbine engine. Such an engine, for example, might be in every way satisfactory for steamers running between Dover and Calais, Holyhead and Dublin, or even between Liverpool and New York, while they would be wholly unfit for a man-of-war. In the first cases the speeds are always the maximum practically possible, and there would be no difficulty in designing engines to suit. In the navy the speeds are wholly various, and for various speeds the turbine engine is not suited. It must not be forgotten again that in a large vessel there would be room for turbines of considerable diameter, and so the velocity of rotation of the screw may be fairly moderate. All things considered, we think it by no means improbable that the turbine steam engine will be largely adopted in the mercantile marine for special high speed services of the ferry type, such as the Atlantic passenger trade, but for warships it is wholly unsuited, the success of the Viper to the contrary notwithstanding, because she is not a warship.—Engineer, London.



B. B. INMAN, DULUTH. COMPOUND ENGINES, 18 AND 36 X 30 INCHES.

C. F. DUNBAR OF BUFFALO. TRIPLE EXPANSION ENGINES, 16, 25 AND 40 X 27 INCHES—ROBERTS WATERTUBE BOILER.



ZENITH OF DULUTH COMPOUND ENGINES, 18 AND 36 X 30 INCHES.

FABIAN OF BUFFALO. ENGINE 23 X 28 INCHES.

SUPERIOR OF DULUTH. ENGINE 22 X 24 INCHES.

AMERICA OF ERIE. COMPOUND ENGINE, 16 AND 34 X 28 INCHES.

Harbor Tugs—A few of the Great Lakes Towing Co.'s Fleet.

The new Ward liner Morro Castle arrived last week in New York from the yards of her builders, the Cramps at Philadelphia, and sailed last Saturday on her maiden trip to Havana. She is a steel twin-screw steamer of 7,000 tons and is the largest of the new swift Havana fleet. She is expected to average about 19 knots. She can accommodate 136 first-cabin, sixty second-cabin and forty steerage passengers. Capt. Cleveland Downs, commodore of the line, is her commander; John Morrissey, chief engineer; H. E. Aspinwall, purser, and John Pearl, chief steward. The Morro Castle is equipped for service as a cruiser. Two other Ward liners, each of 6,000 tons, are under construction and will be ready for sea in about four months.

Arrangements have been made whereby four steamers of the Scandinavian-American line will make regular sailings between Copenhagen and Boston, beginning Nov. 20. The vessels to be sent are the L. P. Holmblad, Antwerpen, Georgos I. and Leopold II.

TRIALS OF THE TORPEDO BOAT VIPER.

The following communication of Charles A. Parsons, inventor of the Parsons steam turbine, to the London Times will be read with interest in these days of high speed torpedo boats:

"The recent trials of the Viper, which is the first torpedo boat destroyer to be fitted with steam turbine propelling machinery, have attracted much attention, and as the results, which have been published from time to time in your columns, have proved entirely successful, the specified speed being greatly exceeded and all previous records (including those of the Turbinia) having been broken, perhaps I may be allowed to discuss certain points in connection with the figures attained which are of considerable interest and importance. We had not ourselves thought of making a strict comparison between the coal consumption of the Viper at any particular speed with that of other vessels of similar tonnage, as she differs in essential particulars from all other vessels, and such a comparison would be entirely misleading unless accompanied by a full statement of the principal features of the vessels to be compared, with their necessary bearing upon the results. But, as other persons have thought well to make an unqualified comparison, I now propose to briefly place the case on a sound footing, and I may add that the comparison is interesting and instructive, especially to those whose business it is to design or to use fast vessels.

"The trials of the Viper have been somewhat more elaborate than usual for torpedo boat destroyers, though they do not by any means as yet cover the whole of the ground. They have included a coal consumption trial of the contract speed of 31 knots, the mean speed during the three hours being 31.118 knots, and the coal consumption, as determined from the usual hull resistance experiments, 2.38 lbs. per I. H. P. per hour, the contract being not to exceed 2.5 lbs. per I. H.P. The power required for this speed is about two-thirds of the maximum for which the engines and boilers were designed, the maximum being upward of 12,300 I. H.P., which power has been realized on preliminary, but official, full power contractors' trials, the maximum mean speed then reached being 36.858 knots.

"The second official trial was a three hours' coal consumption trial, with the air pressure limited to 3½ in., and carrying the full weights as determined by the previous trial under the usual admiralty conditions. A mean speed of 33.838 knots was maintained with about four-fifths of the maximum power, the coal consumption being at the rate of 2.49 lbs. per I. H.P. per hour.

"The third official trial was the usual 12 hours' coal consumption trial at cruising speed. In recent years the stipulated speed on this trial has been increased from 13 knots to 15 knots (this I mention as the coal consumption of the Viper at 13 knots is only about two-thirds of that at 15 knots). The ascertained coal consumption of the Viper on this trial was at the mean rate of 27 cwt. per hour. It should be mentioned, however, that the Cobra, the second fastest ship afloat, with the same sized turbine engines and similar in every respect to the Viper, but loaded to service conditions and having a displacement of 442 tons, or about 60 tons greater than the Viper, consumed on her official 15-knot trial 24.58 cwt. per hour. In her case the port engines only were used, the starboard engines being dragged round by the propellers, and it is probable that the Viper with her less displacement would, when using one set of engines only, burn less coal than the Cobra. As, however, it would be instructive to ascertain this result definitely, it is probable that this test will be made at an early date.

"Now to the case in point: A comparison has been made of the coal consumption of the Viper and the Albatross at a speed of about 31 knots. It so happens that the two vessels have the same displacement, and it is tacitly assumed in the accounts that the horse power necessary to drive the two vessels is the same, which is by no means the case, for the following reasons: In the case of the Viper all the underwater fittings, such as rudder, the shafts and brackets for carrying the propeller shafts, the propeller blades and bosses, etc., have all been designed to stand the highest speed of over 36 knots, and are of considerably larger and heavier scantlings than usual, and in consequence offer increased resistance to their passage through the water. So much for the ship builders' point of view.

"Now for the engineer's side of the question. To give to the Viper her five extra knots, and to absorb usefully the relatively enormous horse power developed by her engines, her propellers have extra width of blade and a much greater total blade area than that of the Albatross, whose maximum horse power is only about two-thirds of the Viper's. This greater blade area is not only useless at lower speeds, but involves a positive waste of power at such speeds, owing to the increased skin friction. If, on the other hand, the Viper's propellers had been designed for a maximum speed of only 32 knots (the contract speed of the Albatross) they would undoubtedly have given superior results of about 31 knots. Then as regards the turbine engines themselves. At the speed of 31 knots the Viper's engines are working at only two-thirds full power, and are necessarily less economical than if they had been smaller and designed for the power required for 32 knots.

"Then there are the boilers to compare—a very important item in the case. The Viper has the well-known Yarrow boilers of simple construction and of great durability and power, but is without any refinements external to the boiler for attaining the highest possible economy of coal—refinements, be it said, of somewhat doubtful advantage in ordinary service. The Albatross, on the other hand, has the well-known Thornycroft boiler; she has also feed water heaters to increase the efficiency, and also compressed air jets for promoting more complete combustion of the furnace gases before coming in contact with the tubes.

"These are now the factors of chief importance bearing upon the question of the relative coal consumptions of the turbine engines and reciprocating engines in the respective vessels. On the one hand we have the larger engines, greater propeller blade area, heavier underwater fittings, greater hull resistance, powerful, durable boilers of simple construction without external adjuncts for attaining the highest economy on trial, the vessel being capable of a speed of five knots in excess of any vessel propelled by reciprocating engines. On the other hand we have a vessel whose engines and propellers are capable of developing only about two-thirds of the horse power of the other, designed for a much lower speed—in fact, about that at which the comparison is taken—and having boilers of noted efficiency in coal, assisted by somewhat complex additions for further increasing the economy. That the reduction in the coal consumption attributable to the aggregate of these important differences greatly exceeds the difference between the coal consumption of the Viper and the Albatross at about 31 knots speed there can be no question whatever, and there cannot be the slightest doubt that in every class of vessel (excepting only very small or slow vessels) it will be found that the turbine system of propulsion will give superior results over the reciprocating engine as regards coal consumption. In the Viper, in spite of these losses of power at lower speeds which we have described, and incurred in order to reach the record speeds attained (speeds only attainable by turbine machinery), without any special effort to attain economy, even so, her coal consumption per horse power realized is very little in excess of the best, and less than that of many of the 30-knot destroyers.

"In the specifications of most admiralties for torpedo boats and destroyers the question of speed is placed in the forepart and enforced under heavy penalties, culminating with the option of complete rejection of the vessel should the deficit reach more than two to three knots below that contracted for. The coal consumption is relatively placed in the background. This being so, the designers of the Viper may be pardoned if they have made every effort to attain the highest possible speed and have not given sufficient consideration to the question of obtaining the utmost economy of fuel of which turbines are capable; but in this their first destroyer they can at least claim to have beaten all records of speed by a long interval, and in their future ships they will be able to show by how much they can beat all records as to economy in coal."

THREE PROGRAMS OF NAVAL CONSTRUCTION.

Three programs of naval construction are now awaiting the consideration of the secretary of the navy. The general board submits a program, the board of construction and repair submits one and Admiral Hichborn submits the third. As the programs of both boards are extensive, and as Hichborn is opposed to them, it follows that he must favor a program of moderate construction. The boards have recommended the building of battleships and armored cruisers. It is understood that Secretary Long is opposed to the construction of any armor clads and in this he is supported by several naval officers. The secretary believes that with sixty naval vessels authorized and under construction it would be a foolish policy to obtain authority to construct big ships, on which work could not be started for a very long time, and that with a congressional embargo on the construction of armored vessels until the armor controversy has been settled to the satisfaction of the government an indefinite time must elapse before contracts for the construction of armorclads authorized at the last session of congress can be made. The policy of the department proper is to arrange at the next session of congress for the construction only of some light-draught gunboats for use in the Philippines and a few necessary supply ships, and perhaps a training ship or two. The reports of the general board and the board on construction are therefore likely to be disapproved and the secretary's recommendation to congress will include only gunboats and supply ships.

The general board of the navy, of which Admiral Dewey is president, is composed entirely of line officers. Its duties are to prepare plans for defending the coasts and for the operations of fleets in time of war. The greatest care was taken by the department in organizing the board to have its members understand that it must not infringe on the duties of the construction board. The general board, however, submitted a building program, which Secretary Long referred to the construction board for its consideration. This building program provides for two battleships, two armored cruisers, six gunboats, two torpedo boat destroyers, three torpedo boats, one troop transport and two training ships. The size of these vessels was not prescribed by the general board.

After much consideration of the subject of the increase of the navy, the board on construction recommended a comprehensive program, including thirty-six vessels, to cost $42,000,000. This calls for the construction of three battleships of about 13,500 tons each, three armored cruisers of about 13,500 tons each, six gunboats, a composite of the Yorktown and Marietta types, of about 2,000 tons each, six gunboats of about 600 tons each, ten gunboats of about 200 tons each, three colliers of about 15,000 tons each, one machinery repairing ship of about 7,000 tons, and one troop transport of about 7,000 tons. Four members of the construction board signed a memorandum containing these recommendations, although it was apparent that some of the members were opposed to the construction of any war vessels except gunboats. The fifth member, Chief Constructor Hichborn, declined to sign, and is preparing a separate memorandum.

The board's recommendations are the result of a compromise. Two of the four members who signed the majority report maintained that the United States should keep pace with the increase of foreign navies, and pointed out Germany's extensive building program as an example. The two other members held that Germany, Russia and other European countries had much more to fear than did the United States, and that the building program of the American navy should be determined solely with reference to American needs and not dictated by the activity of foreign naval establishments. Some members of the board were in favor of building battleships and armored cruisers, while others held that, with so many armorclads under construction, it was necessary to provide only some additional gunboats of light draught for use in the Philippines. Four of the board's members finally compromised, the suggestions of each of them being embodied in the memorandum to the secretary of the navy.

Successful experiments with Marconi's system of wireless telegraphy were made last Saturday night from the mail boat Princess Clementine while she was steaming from Ostend to Dover. The first demonstration was made while the steamer was actually passing the mast erected on the land at La Panne, between Ostend and Dunkirk. Constant messages were sent to and fro at the rate of twenty words a minute until Dover, which is 61 miles distant, was reached.

One hundred and twenty-four days on a voyage during which Cape Horn was rounded is the record of the sailing ship William J. Rotch, Capt. Sewall Lancaster, which entered Boston harbor last week. She came from Port Blakely, Washington, and brought a valuable cargo consisting of 478 spars, 106,903 ft. deck plank and 741,000 cedar shingles to the Boston Oregon Mast Co. of Boston. It is some years since a similar cargo entered the port of Boston.

ST. PAUL LOSES STARBOARD PROPELLER.

The American liner St. Paul entered New York harbor last Sunday morning with her starboard propeller gone, part of her tail shaft missing and her starboard engine badly wrecked. The New York papers say that she limped into port, but limping is hardly the word to be applied to a speed of 16 knots. The fact that she did as well as this is the incontestible virtue of the twin screw. Accounts vary as to what actually happened but these facts may be related: About 8 o'clock on Wednesday evening (Oct. 31), while running at full speed, a distinct shock was felt throughout the ship, the starboard tail shaft broke and with the wheel fell into the water. The starboard engine, freed from its mass of whirling machinery, wrought havoc in the engine room. Almost in an instant the starboard engine was a wreck. Steam was shut off, it is claimed, within ten seconds. One story is to the effect that the chief engineer happened to be in the vicinity of an emergency valve at the instant the shock was felt and reached for it, shutting off the steam. According to another story, one of the assistant engineers heroically threaded his way through the escaping steam and crashing metal and turned off the steam in the engine room. It is agreed, however, that within a very short time after the accident the ship was proceeding as though nothing had happened under two-thirds steam with the port engine. Few of the passengers gave the occurrence a thought; indeed the most of them had not observed it. Various causes have been advanced for the breaking of the shaft. It was at first given out that the propeller had struck a derelict. The impression seems to be, however, that the tail shaft parted when an unusually heavy sea threw the stern out of water and started the engines to racing. This is one of the common causes of shaft breaking and is more than likely to be the case. After an examination of the starboard engine room in New York, Acting General Manager Bettle of the International Navigation Co., gave out the following statement:

"The St. Paul's starboard propeller and part of the propeller shaft were carried away. We presume the propeller struck a submerged derelict, but of this we cannot, of course, be certain, since no derelict was seen. Had it been seen the propeller would not have hit it. As a result of the accident one cylinder head was blown out, one cylinder head was cracked, one piston rod was twisted and several small steam pipes and a gallery grating were carried away. It will cost to repair the damage about $50,000, and the time required to make repairs will be from six weeks to three months. It will not take less than six weeks and I don't think it will take longer than three months. It must be remembered, however, that only a part of the engine can as yet be seen. The cost of repairs and the length of time it will take to make them can only be determined by an accurate survey. It has not been finally determined, but the repairs will probably be made at the works of the Cramps, Philadelphia."

The accident in its effect is somewhat similar to that which took place in the engine room of the City of Paris when all her starboard cylinders went to pieces off the Irish coast in March, 1890. For the present the Friesland will touch at Southampton.

NO MORE TORPEDO CRAFT TO BE BUILT.

A definite decision not to build any more torpedo boat destroyers or torpedo boats has been reported by the naval authorities, and unless congress should direct to the contrary, this policy will be adhered to during the present administration of the navy department. In directing the board of construction to prepare a program of naval increase for the next fiscal year, the secretary of the navy suggested that there be no provision for torpedo craft. This suggestion led to considerable discussion in the board as to the utility and practicability of destroyers and torpedo boats, and there appeared to be an almost general sentiment that there was little to gain and much to lose in their construction. From the technical standpoint it was shown that these vessels deterioraed very rapidly when not in service, and that their enforced idleness during the winter months had a ruinous effect on hull and machinery. From the standpoint of their usefulness as war machines, there was a surprising unanimity of opinion in the board that torpedo boats were largely experimental and that they had never demonstrated what had been claimed for them. Some of the members of the board expressed the belief that torpedo craft were more troublesome than useful in hostile operations and could just as well be dispensed with, even where an American fleet was operating against an enemy's naval forces to which a strong torpedo boat flotilla was attached. While no more definite information as to the views expressed by members of the board on the subject is obtainable, it is known that there was a cordial indorsement of the views of the department proper that no more vessels of that type should be constructed.

It is understood that the order for the new defender of the America's cup is already with the Herreshoffs. The syndicate this year, it is reported, is unusually large.

The Bath Iron Works will build the dock gate for the Portsmouth navy yard. It is about 116 ft. long and with machinery is worth about $30,000.

The Marine Vapor Engine Co. and the Marine Engine Co. have been absorbed by the Marine Engine & Machine Co. of Harrison, N. J.

CROWDED SHIP YARDS.

GOVERNMENT UNABLE TO SECURE THE CONSTRUCTION OF A DREDGE WITHIN TEN MONTHS—NOTES FROM THE DIFFERENT SHIP BUILDING DISTRICTS.

It was noted in these columns last week that Major Thos. H. Handbury of the United States engineer corps and a member of the Mississippi river commission, who is stationed at Detroit, Mich., found that on account of the crowded condition of ship yards throughout the United States he could not arrange for the construction within ten months of a large dredge that is required for Mississippi river work. Major Handbury now tells himself in a letter to the Review of his experience in the matter. He says: "But one proposal was received under my advertisement of Sept. 14, 1900, and opened Oct. 30, for the construction of the steel-hulled, twin-screw, self-propelling hydraulic dredge designed for use in opening the south west pass of the mouth of the Mississippi river. This was from the Townsend & Downey Ship Building & Repairing Co., New York, in the sum of $389,000. As there is not to exceed $340,000 available for the construction of this dredge, the proposal was, of course, rejected. Letters of regret that they were unable to submit proposals on account of their shops and yards being full of work for several months ahead were received from several of the largest ship building firms of the country. While this condition of affairs in the ship building line may for a time inconvenience certain important government interests, it certainly emphasizes in a very gratifying manner the prosperity of the country at this moment."

At Jeffersonville, Ind., Ed. Howard is completing two handsome light-draught steamboats. One is intended for Chattahoochee, Apalachicola and Flint river trade, with Capt. W.R. Moore, manager. She is named W. N. Kelly and will reach her point of destination, going to New Orleans, thence by coast around to Florida. She is 150 ft. long, 32 ft. beam, 4 ft. depth of hold, and has been built for the purpose of carrying cotton. Her engines are 13-in. cylinders, 5 ft. stroke. She has two boilers, each 42 in. diameter, 20 ft. long, with six 8-in. flues. She is supplied with electric lights and all the improvements. The other boat is the Alma, built for the cotton and general freight and passenger business on the Red river, for the Atkins Bros. Two new model barges have also been built to go with her. The Alma is 155 ft. long, 32 ft. beam and 4 ft. hold. Her engines are 12-in. cylinders, 5 ft. stroke. She has two boilers, each 42 in. in diameter, 22 ft. long, with nine 6-in. flues in each. She has a modern electric light plant that will light up the bends of the river at night. Both boats are well built, have handsome cabins and are supplied with every comfort and convenience for passengers.

As already noted in these columns, the Maryland Steel Co., Sparrow's Point, Md., has on hand an unusually large amount of work. The contracts involve several million dollars, embracing three steamships of over 11,000 tons capacity each, three torpedo boat destroyers, a steel floating dry dock, two steamships for the Boston Steamship Co., two steamships for the Atlantic Transport Co., two sea-going dredges for service in New York harbor, and a steel barge for the Pennsylvania Railroad Co. There are now employed in all departments of the Maryland Company's works about 3,400 men, which force will be increased to 4,000 men before the close of the year.

The steel tug Spartan, built by the Neafie & Levy Ship & Engine Building Co. for F. W. Munn, the Sterling Coal Co., and others, made a successful trial trip last week on the Delaware river, developing a speed of 16¼ miles. She is 135 ft. long, 26 ft. 5 in. breadth of beam, and 15 ft. 5 in. depth of hold, and is provided with triple expansion engines, steel boilers to stand a pressure of 165 lbs., electric lights and a search light, and is as fine a vessel as was ever built in America.

At the ship yard of Enoch Moore & Sons Co., Wilmington, Del., the new derrick lighter Clayton, building for the Pennsylvania Co., has been launched. The tank barge No. 83, belonging to the Standard Oil Co., is out on the railway. The company is making repairs to the barge Florence, and there is considerable other work on hand.

The much-talked-of new ship yard at Mystic, Conn., promoted by Mr. Isham, is a myth. It has been an attempt to financially interest Mystic people in such a venture, the promoter and manager having no available capital. Nothing has been done during the past five months and the scheme has dropped through.

A wooden schooner, the Clifford N. Carver, built under the personal supervision of Capt. S. C. Thompson, was launched at Bath, Me., last week. The Carver is a four-masted vessel of 1,100 tons register, 173 ft. long, 39 ft. beam and 18 ft. depth of hold. She is intended for the general coastwise trade.

The Thames ship yard for the construction and repairing of wooden vessels, New London, Conn., has began work on two marine railways, one of 2,500 tons deadweight and the other of 1,000 tons. A large wooden joiner shop is nearly completed and foundations are being laid for other brick buildings.

The Merrill-Stevens Engineering Co., Jacksonville, Fla., have just completed a new set of marine railways of 800 tons capacity. The cradle is 160 ft. long and is built of steel. Vessels of 12 ft. draught forward and 18 aft can be accommodated.

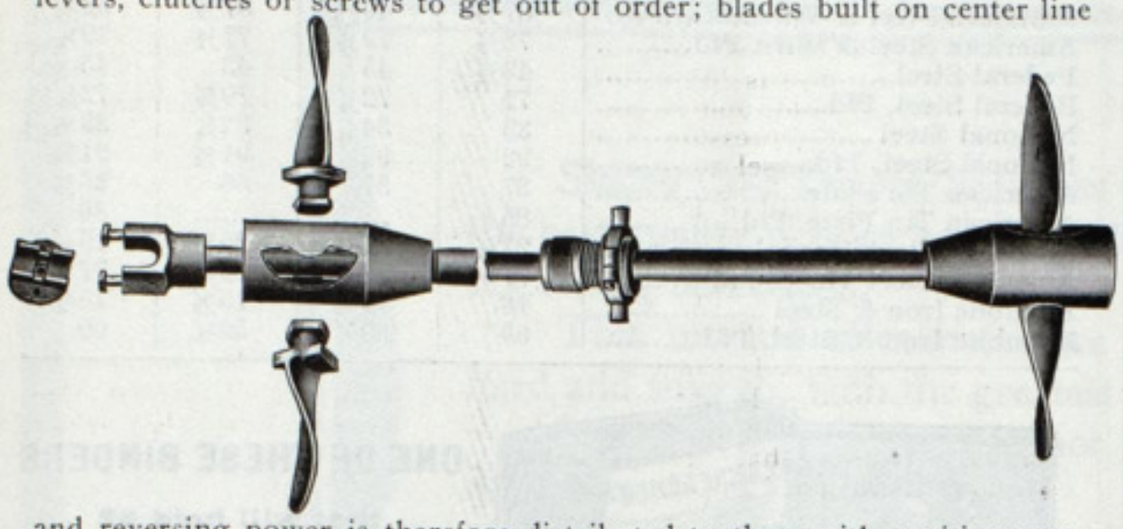
Arrangements are being made to launch the monitor, known as No. 8, now building at the Bath Iron Works, Bath, Me., during the latter part of the month. Miss Grace Boutelle of Bangor, Me., will christen the vessel.

On Saturday the monitor Arkansas will be launched from the yards of the Newport News company, Newport News, Va. Miss Bobbie Jones, daughter of Gov. Jones of Little Rock, Ark., will christen the vessel.

S. Nickerson & Sons, Boothbay Harbor, Me., have contracted with W. I. Adams of East Boothbay to build a first-class wooden schooner, suitable for mackerel or bank fishing.

CRESCENT REVERSIBLE PROPELLER.

A reversible propeller wheel, recently patented by the Superior Gas Engine Works of West Superior, Wis., and made of phosphor bronze, is illustrated herewith. It is called the Crescent wheel and is made with two, three or four blades. Blades are interchangeable and easily removed and replaced. Claims of advantage made for the wheel are: No gears, levers, clutches or screws to get out of order; blades built on center line



and reversing power is therefore distributed to them with positive evenness, overcoming all tendency to bind or cause friction when in motion; wheel can be so pitched by means of the operating lever as to work the boat at anything from full speed ahead to full speed astern, furnishing no power whatever when the lever is on center; reversing lever can be placed at any desirable and convenient point in the boat; also economy in first cost and in maintenance.

The William Penn Steamship Co., Limited, has been incorporated in London, with a capital of £100,000 in £1 shares. The directors are Frank L. Neall, Edgar G. Thomas and J. Rodman Paul. The purpose of the new company is to build and own steamships. The agents of the new line will be Peter Wright & Sons. Contracts have been given for the construction of two steel steamships for the Philadelphia and European trade. The Cosmopolitan Steamship Line, whose interests are almost identical, have chartered the steamships Canadia, Euxinia and Thordis for three years, to run in connection with the fleet of vessels now trading between Philadelphia and ports in the United Kingdom and the Continent.

The old wood sound steamboat Providence, built in New York in 1867, will be used no more by the N. Y., N. H. & H. R. R. Co. She has been stripped of her equipment and all portable articles of value and moved to a wharf in the maritime grave yard at Newport. For twenty-five years she was one of the most popular and comfortable sound steamboats.

PHOTOGRAPHS OF LAKE VESSELS.

It is not an easy matter to secure good photographs of lake vessels, even in the connecting rivers. This is especially true when an effort is made to get large pictures. A photographer who spent a couple of weeks in September on the St. Clair river making pictures for the Review did not succeed in getting all that he expected, but some of the views are very fine. The negatives are 11x14 in. No photographs of this size are to be had from any other source. There is no background in any of them—just clear sky and open water. Following is the list:

STEAMERS.

Angeline	Iosco	Pontiac
Birckhead, P. H.	Iron King	Pridgeon, John, Jr.
Boston	Kaliyuga	Princeton
Boyce, Mary H.	Leafield	Queen City
Buffalo (two views)	Linn, Wm. R.	Ravenscraig
City of Alpena (Side-wheeler)	McWilliams, John J.	Rees, W. D.
	Maruba	Reis, Wm. E.
Conestoga & Monarch (on one print)	Mariposa	Rhodes, W. C.
	Mataafa	Sacramento
Davidson, Thos.	Mills, Robt.	Saxon
Delaware	Nicholas, I. W.	Susquehanna
Eddy, John F.	Nicol, John M.	Sparta
Hanna, M. A.	Northern Light	Stevens, W. H.
Harper, John	Northern King	Syracuse
Hopkins, Mark	Penobscot	Tuscarora
Huron	Pittsburg (Pass. stmr.)	Wilbur, E. P.

TOW BARGES.

Abyssinia	Chattanooga	Olive Jeanette

A single print will be delivered to any address, express prepaid, at $1.50, or $5.00 for four. These photographs are too large to trust to the mails. If called for at the office of the Marine Review, Perry-Payne building, Cleveland, copies may be had at $1.25 each.

On account of the great amount of personal business matter which demands much constant care and attention, Mr. Gilbert N. McMillan has been obliged to resign the position of purchasing agent with the Eastern Ship Building Co. of New London, Conn. J. F. Kemp, formerly of the Detroit Dry Dock Co., has been appointed his successor.

Hunters' Rates—From Nov. 9 to Nov. 30 the Nickel Plate road will sell excursion tickets to hunting parties of three or more traveling together on one ticket at one fare for the round trip. Return limit Dec. 2. There are immense quantities of small game along the line of the Nickel Plate road in western Ohio and Indiana. Write, wire, 'phone or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O. 247 Nov. 30.

PNEUMATIC PLANT AT CHARLESTOWN NAVY YARD

The new pneumatic plant at the Charlestown navy yard was used last week for the first time, and proved a great success. The plant is the first of two which are to be set up at the yard for the department of construction and repair. The other plant, which will not be completed for several months, will be in the new power station, at the lower end of the yard. The two plants are to be connected by a system of piping which has already been laid. The pneumatic power is for operating chipping, caulking, riveting and other light tools used in repairing ships. Compressed air from the upper plant was used for running the scaling hammers on the sides of the hull of the double-turreted monitor Amphitrite, which is in the dock for a thorough cleaning and overhauling, and for planing down a part of the forward turret. The power is transmitted from the pipe line which runs along the side of the dock to the hammers by means of a number of lengths of flexible steel-wound hose. These hammers resemble bicycle pumps and are operated by a valve regulated by hand. The hammers are about 2 ft. long, are easily regulated, and with them a man can accomplish a great deal more than with the old chippers. The pneumatic system has proved so successful that it is expected it will gradually be extended until all the tools are operated by it. Compressed air and electricity are destined soon to supplant steam as the motive power for most of the machinery at this navy yard.

LARGE PURCHASES OF MACHINERY.

The navy department is preparing to install in the shops of the naval station at Bremerton, Wash., new machinery to the value of many thousands of dollars. When this machinery is in place, which is expected to be within the next six months, the Puget Sound naval station will be prepared to handle in excellent shape any job of refitting or repairing that may be assigned to it. Bids will be received in the office of the bureau of supplies and accounts at Washington until 1 p. m., Nov. 13. Bids will be opened at the same time for furnishing the station with a large quantity of miscellaneous supplies, among other things listed in the call being the following: Seven tons of coke, 44 gross of heavy brass screws, 11,500 lbs. of ingot copper, 1,300 lbs. of tin, 10,700 lbs. of wrought iron, 4,550 lbs. of Norway iron, 20 bales of oakum and 48,500 ft. of yellow fir. Bids are also being asked for the construction of a steel and brick addition to the building containing the dry dock pump and boilers. The call is issued by the bureau of yards and docks. These bids will be opened Nov. 10. It is planned ultimately to double the size of the pumping station but only about half of this extension is to be made at the present time. The addition to be immediately constructed will be 32 ft. 9 in. by 50 ft. The framework will be of steel, the walls of brick and the roof of slate.

TRADE NOTES.

The Abner Dable Co., corner Fremont and Howard street, San Francisco, will hereafter represent the Bethlehem Steel Co. on the Pacific coast.

The foundry of the Morgan Engineering Co., Alliance, O., has been completed, and was formally opened on Oct. 29. It is one of the largest in the country, the main building being 300x125 ft., and 75 ft. from floor to roof. It has three cupolas and seven electric overhead traveling cranes.

Among contracts recently awarded to the American Bridge Co. are the following: Seven new bridges on the Allegheny Valley Railroad; steel work for new shops for the Northern Pacific Railroad Co. at Brainerd, Minn.; structural steel work of the Germantown junction station of the Pennsylvania Railroad.

John S. Bushnell, who has moved from No. 120 to No. 126 Liberty street, New York, announces that his facilities have been greatly increased. He has taken the sole agency for the Engineering & Power Co., formerly of 39 Cortlandt street, and will carry a full line of their indicators. In addition to indicators his specialties include reducing wheels, planimeters, grate bars, tube cleaners, packing, steam separators, filters, damper regulators, etc.

The John A. Roeblings Sons Co., Trenton, N. J., secured two grand prizes at the Paris exposition. One prize was for wire one-one-thousandth of an inch in diameter. One mile of this wire weighed a quarter of an ounce. The exhibit included wire of all kinds, from this up to samples of cables used on the Brooklyn bridge. In addition to the two grand prizes, the company received two gold medals. The second exhibit of the company was a full line of electrical trolley tracks and wires. A feature of the exhibit which attracted much attention was an exact model of the Brooklyn bridge. Owing to the great increase in its trade, this company has very largely increased its manufacturing capacity, and has built a complete wire mill, which is probably the most extensive single mill in the world.

VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland, date of November 7, 1900.

NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire.....	37½	40⅜	37½	39⅝
American Steel & Wire, Pfd.....	78½	79½	77½	79½
Federal Steel	43½	45	43	45
Federal Steel, Pfd.....	71	72¾	70½	72¾
National Steel	33	34	32¼	33½
National Steel, Pfd.....	92	92	91½	91⅞
American Tin Plate	37	37	36	36½
American Tin Plate, Pfd.....	86	.....	.....	86
American Steel Hoop.....	27½	27½	25½	26½
American Steel Hoop, Pfd.....	77	77	75	77
Republic Iron & Steel	16	16⅛	15½	15¼
Republic Iron & Steel, Pfd	60	60¾	59¾	60

Treasury Department, U. S. Life-Saving Service, Washington, D. C., November 2, 1900. Sealed proposals will be received at this office until 2 o'clock p. m., of Saturday, November 17, 1900, and then publicly opened, for the construction of ten 34-foot self-righting and self-bailing lifeboats, with centerboard, six to be delivered in Grand Haven, Michigan, and four on the grounds of the Monmouth Beach Life-Saving Station, near the Galilee Railroad Station, New Jersey. Plans and specifications, forms of proposal, and full information can be obtained upon application to the Inspector of Life-Saving Stations, 17 State Street, New York City; to the Assistant Inspector, 1st and 2nd Life-Saving Districts, Room 148 Postoffice Building, Boston, Mass.; to the Assistant Inspector, 10th and 11th Life-Saving Districts, Room 204 Postoffice Building, Detroit, Michigan; or to this office. S. I. Kimball, General Superintendent. Nov. 8.

Sealed proposals will be received at the office of the Light-House Engineer, Buffalo, N. Y., until 12 o'clock M., December 15, 1900, and then opened, for constructing two beacons with lanterns and a fog-signal house, including foundations and protection work in the main south entrance of the new breakwater at Buffalo, N. Y., in accordance with specifications, copies of which with blank forms of proposal and other information may be had upon application to this office. T. W. Symons, Major, Corps of Engineers, U. S. A. Nov. 15.

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PLANERS OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.

PLUMBING, MARINE.
Ellis Marine Plumbing Co.....New York.
Mott Iron Works, J. L.....New York.
Sands, Alfred B. & Son.....New York.
Kenney, The Co.....New York.

PNEUMATIC TOOLS.
Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.

PROJECTORS, ELECTRIC.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Davidson, M. T.....Brooklyn, N. Y.
Kingsford Foundry & Machine Works....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SCHOOLS, CORRESPONDENCE—ENGINEERING AND NAVIGATION.
American School of Correspondence.....Boston.
Buffalo Nautical School.....Buffalo.
Chicago Nautical School.....Chicago.

SCREW MACHINES.
Niles Tool Works Co.....Hamilton, O.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Townsend & Downey Ship Bldg. Co.....New York.
Trigg, Wm. R. Co.....Richmond, Va.
Union Dry Dock Co.....Buffalo.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Marine Supply Co.....Fairport Harbor, O.
Moran Bros. Co.....Seattle, Wash.
Upson-Walton Co.....Cleveland.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEEL OR IRON STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

STEAMSHIP LINES, PASS. AND FREIGHT.

American Line.....New York.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL SHAFTS, SOLID OR HOLLOW.

Bethlehem Steel Co.....South Bethlehem, Pa.

STEERING APPARATUS.

American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.

Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.

Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.

American Bridge Co.....New York.

SURVEYORS, MARINE.

Curr, Robert.....Cleveland.
Gibbs & Joys.....Milwaukee.

TELEGRAPH—DECK AND ENGINE ROOM.

Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.

Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.

Helios-Upton Co.....Peabody, Mass.

TIMBER—LARGE PIECES.

Moran Bros. Co.....Seattle, Wash.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.

Chicago Pneumatic Tool Co.....Chicago.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pelton Engineering Co.....Cleveland.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.

Fay & Egan Co., J. A.....Cincinnati, O.

TRUCKS.

Boston & Lockport Block Co.....Boston.

TOWING MACHINES.

American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.
Playfair's Barge & Tug Line.....Midland, Ont.

TOWING COMPANIES.

Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Swain Wrecking Co.....Detroit.

TUBING FOR BOILERS.

Shelby Steel Tube Co.....Cleveland.

VALVES, STEAM SPECIALTIES, ETC.

American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Jenkins Bros.....New York.

VARNISH MAKERS, COLOR GRINDERS, ETC.

Smith, Edward & Co.....New York.

VARNISH PAINT.

Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.

Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys.....Milwaukee.
Hall & Root.....Buffalo.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Mitchell & Co.....Cleveland.
Moffat & O'Brien.....San Francisco.
Pauly, H. J.....Milwaukee.
Richardson, W. C.....Cleveland.

VENTILATING APPARATUS FOR SHIPS.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.

American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.

American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.

American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.

American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.

Fay & Egan Co., J. A.....Cincinnati, O.

WORM GEARING.

Morse, Williams & Co.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.

Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Playfair's Barge & Tug Line.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.

Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.

Drein, Thos. & Son.....Wilmington, Del.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.

Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

CLEVELAND CITY TICKET OFFICE,
237 SUPERIOR STREET.

Eastward:—	Ar. fr. West.	Dep. East.
No. 18, Southwestern Limited	.....	*1 55 am
No. 22, Lake Shore Limited	*2 15 am	*2 20 am
No. 28, New York & Boston Express	*7 40 am	*8 00 am
No. 32, Fast Mail	*11 25 am	*11 30 am
No. 44, Accommodation, via Sandusky	†1 25 pm	.....
No. 46, Southwestern Express	.....	*3 00 pm
No. 6, Limited Fast Mail	*5 40 pm	*5 45 pm
No. 10, Chicago, New York & Boston Special	*7 35 pm	*7 40 pm
No. 16, New England Express	*10 30 pm	*10 35 pm
No. 2, Day Express	†9 05 pm	†9 20 pm
No. 126, Norwalk Accommodation	†7 55 am	.....
No. 40, Toledo & Buffalo Accom., via Norwalk.	†10 00 am	†10 30 am
No. 126, Norwalk Accommodation	†7 55 am	.....
No. 116, Conneaut Accommodation	.....	†4 30 pm

Westward:—	Ar. fr. East.	Dep. West.
No. 11, Southwestern Limited	*3 25 am	.....
No. 15, New York, Boston & Chicago Special	*3 05 am	*3 10 am
No. 21, New York & Chicago Express	*5 10 am	*5 20 am
No. 7, Day Express	.....	†6 30 am
No. 19, The Lake Shore Limited	*7 35 am	*7 40 am
No. 23, Western Express	*11 10 am	*11 15 am
No. 33, Southwestern Express	*12 25 pm	.....
No. 133, Cleveland & Detroit Express	.....	*12 30 pm
No. 47, Accommodation	.....	†3 00 pm
No. 141, Sandusky Accommodation	.....	†3 10 pm
No. 127, Norwalk Accommodation	.....	†5 10 pm
No. 37, Pacific Express	*6 35 pm	*7 00 pm
No. 3, Fast Mail Limited	*10 50 pm	*10 55 pm

*Daily. †Daily except Sunday.
Trains Nos. 28 and 37 run via Erie station. .

WANTED FOR SALE, FOR CHARTER Etc.

Space under this heading 25 cents a line, each insertion, for three insertions or less. Special rates for periods of more than three insertions.

—FOR SALE OR EXCHANGE—Forty acres No. 1 fruit land overlooking Kalamazoo river, Michigan, for fish tug or machinery suitable for 50 ft. hull. Geo. Wolf, 232 Hamilton street, Cleveland, O. Nov. 8

—WANTED—Steam vessel of about 50 ft. length, 5 ft. draught and 25 H.P. Address Eric, care the Marine Review Pub. Co., Perry-Payne Bldg., Cleveland. d

—FOR SALE—A new $1,200 gasoline launch for $700; guaranteed at every point. Address C. N. Tallman, care Post Standard, Syracuse, N. Y. Nov. 15

—WANTED—Loan of $1,000 on steamboat property. Will give good security. Address box 10 the Marine Review Pub. Co., Cleveland, O. Nov. 8

—WANTED to purchase, rent or charter tug and scows, capacity of the latter to be 1,000 to 1,500 tons. Steambarge owners correspond. Stone to the transported from our pier at Stone Haven, 7 miles north of Port Washington, to Lake Michigan ports. Lake Shore Stone Co., Belgium, Ozankee Co., Wis. Nov. 8

—FOR SALE—Passenger steamer 177 ft. over all. In good condition. Carries 500 tons freight. Allowed 500 passengers; will sleep 120 and can be made to sleep 200. Steeple compound engines, double fire-box boiler. Speed, 11½ miles. Reason for selling is that vessel is not speedy enough for present service. Address Passenger steamer, The Marine Review Pub. Co., Cleveland. tf

—FOR SALE—Two tugs, one of 65 ft. keel with engines 20x22 and the other of 61 ft. keel with engines 20x20. Ranney Bros., 34 River st., Cleveland. Nov. 15

—FOR SALE—Good tug, six years old. Engines 18x20. Boiler allowed 130 pounds steam pressure. Address Box 284, Ashland, Wis. tf

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